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SPECIAL REPORT

OPEN-SOURCE SOFTWARE

Is Linux Really a Microsoft Slayer?

- PC Labs Tests Four Versions of Linux
- Also: Preview of Communicator 5

• **Invest Online**
The Best Sites For Trading, Info, and Chat

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- Conversa Messenger



THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.6 MARCH 23, 1999

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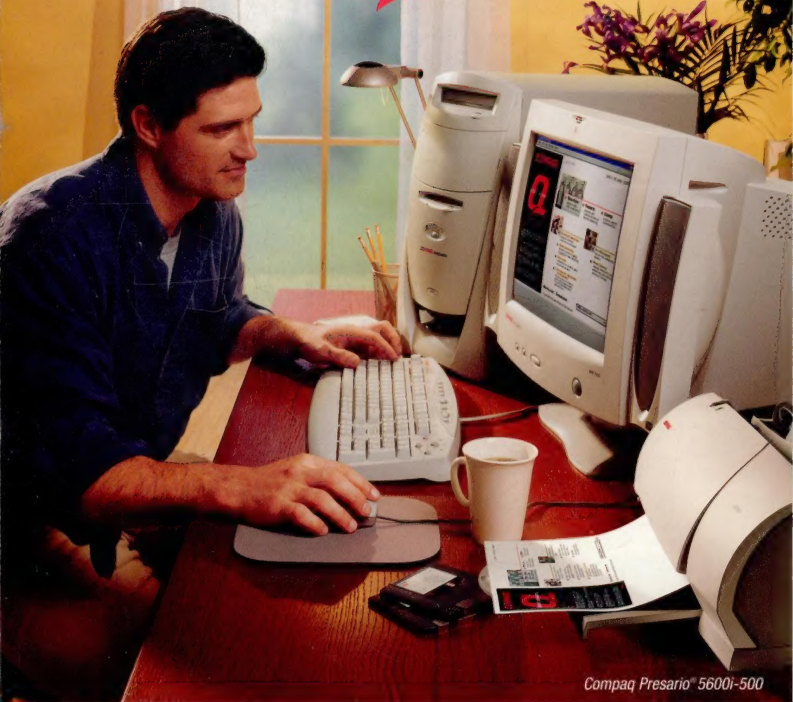
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Linux: An Underdog Emerges

Pundits in the industry—including yours truly—have long been saying that the greatest threat to Microsoft isn't another large company but rather someone no one has heard of. The idea sounded good, but when we all started saying it, it was just a theory. Now that theory is being put to the test. The concept

has some history behind it. From the sixties until the mid-eighties, IBM was the clear master of the computing universe. While IBM saw larger companies such as Digital Equipment Corp. and AT&T as its major competitors, its role was actually usurped by the then-little-known Microsoft. In the transition from big systems to personal computers, a new leader emerged.

In the backs of our minds, many of us have been looking for the one small company that would come out of nowhere to challenge Microsoft. After all, we are currently moving into an era centered on the Internet. For a while that competitor seemed to be Netscape. Its browser and its use of Sun's Java set up a new platform for applications. But Microsoft reacted quickly and aggressively, and thus far at least, it seems to have beaten back that challenge, driving Netscape into the arms of AOL.

AOL now could be that competitor. Though not exactly a new company, its growth in recent years has startled just about everyone except chairman Steve Case. AOL has become the largest gateway to the Internet, and its acquisition of Netscape and deal with Sun Microsystems position it to control the way the Internet appears to a huge number of consumers.

But today, in many ways, the biggest threat to Microsoft may come not from a company at all but from an individual programmer and the effect his free software is having on the industry.

That programmer, of course, is Linus Torvalds, who was a graduate student at the University of Helsinki in 1991 when he wrote his own version of the operating system Unix, which came to be known as Linux. Inspired by the free software theories of GNU's creator, Richard Stallman, and the success of software such as sendmail, the mail backbone of the Internet, Torvalds made his soft-

ware freely available to the public. He not only made the program free to anyone who wanted to download it, but he released the source code as well, requiring only that people who published it distribute the source code and make public all their changes as well.

At first this was just a curiosity. But other "open-source" software such as the Web server Apache and the scripting language PERL soon appeared as well. Such software eventually became an integral part of the Internet, running a huge percentage of the Web—all without attracting too much notice. (We first covered Linux in 1997 and Apache in 1996;

later in this issue, we take a closer look at the open-source movement.)

Proponents of open-source code say that publishing the code is in fact an exercise in natural selection. Anyone can find and correct bugs in a piece of software, and the best additions and corrections get incorporated in the program's next major release. The result, they say, is cleaner and more efficient software.

The success of Linux and Apache has led other companies to adopt the model. Netscape is basing the next major version of its browser on an open-source version known as Mozilla.

Even stodgy old IBM is joining the act.

This poses a major threat to Microsoft, which has so far jealously guarded its source code as the source of its great profit margins. In fact, it has been pretty well blindsided by open-source's acceptance. Of course, Microsoft has faced its distractions lately, in the form of a prolonged antitrust case, just as IBM had been in when Microsoft first came to prominence.

It's not surprising that Microsoft would face an upstart competitor at this stage in its growth. But from a grad student who gave away his software? Who would have thought it? **PC**

**In many ways,
the biggest
threat to
Microsoft may
come not from
a company at all
but from an
individual
programmer.**



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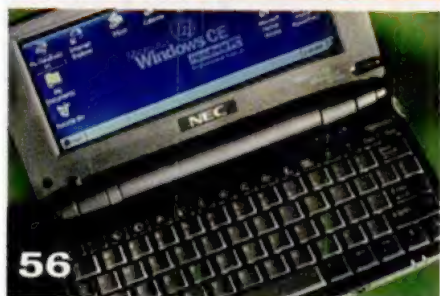
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Cover photography: John Wilkes (bottom), Thom O'Connor (top)



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Pentium III, Continued

Download feature and performance data for the PCs in our cover story. Join our discussion. And stay on top of the latest information on Intel's new CPU.

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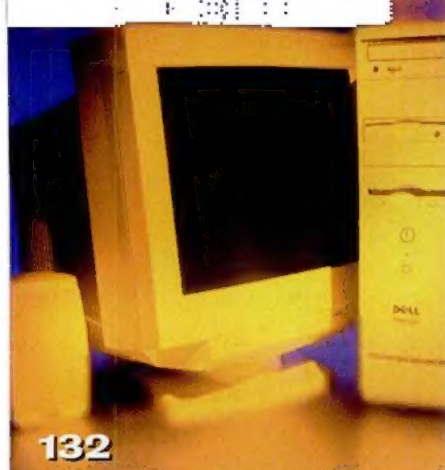
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COVER STORY

100 Pentium III Hits 500

Although Intel's newest Pentium is faster than its predecessor, not every application stands to gain. Here, we test the first seven Pentium III PCs to hit the street and tell you when they're worth the investment. Plus: An inside look at what Intel and rival AMD have in store this year. *By Cade Metz*

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Forget those high commissions! We bought and sold stocks on 34 leading sites and report on their execution speed, reliability, and customer support—and whether they suit *your* investment style. *By David Lidsky*



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The growing popularity of Linux is leading the charge to open-source software. But can you safely build your business on Linux? Will it overtake Windows NT? Not according to Microsoft. Yet some major vendors—including IBM, Oracle, and Sun—see things differently. *By Larry Seltzer*

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Motorola
Satellite Series
9500: A truly global
portable
phone—with
right-next-
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Do computer makers believe that every time they come out with new product, I get a new budget?

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In Mat¹tel at Play

Intel has conquered the desktop market and now has its sights set on toyland. The company is collaborating with experts in the toy industry to come up with a new class of toys that draw on the power of the desktop computer. Its objective is to create technologically evolved toys that put high demands on the desktop PC, not toys that have much standalone computing horsepower. The company makes no secret of its motivation to drive sales of desktop microprocessors.

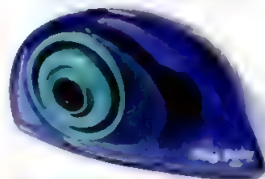
By combining its technology expertise with Mattel's play and toy expertise, Intel is hoping that the first entries in its line of Intel Play PC-enhanced toys will grab—and keep—kids' attentions.

Rand Potter, who heads up Intel's interactive toy group, recently debuted Intel's initial try in the toy market at the American International Toy Fair in New York. The Intel Play X3 Microscope and Intel Play Me2Cam, available this fall for

about \$100 each, were designed jointly by a team of engineers and designers from Intel and Mattel. The microscope has a digital video camera, so kids (and adults) can display assorted specimens on their PC screens, magnify them (up to 300x), and save images. The microscope can also be detached from its base so kids can explore the world around them. The built-in camera lets kids create time-lapse movies or photos and then print, e-mail, or produce on-screen shows.

With the Me2Cam positioned atop a monitor, kids can see themselves on the computer screen, and a blue screen backdrop enables them to use their own bodies to navigate a virtual world. The system will include a digital video camera and a suite of activities on CD-ROM.

The Intel Play X3 Microscope.



The Intel Play Me2Cam.

Who Ya Gonna Call?

How important to you is the data on your hard disk? According to Nikki Stange, who has the title of "Data Crisis Counselor" at hard-disk rescue company DriveSavers, when people call her after losing access to data on their hard disks, they're invariably in panic mode. Stange has helped rescue a year's worth of episodes of "The Simpsons" and original songs by the musician Sting.

Though DriveSavers uses proprietary rescue software to redeem lost hard-disk data, JungSoft approaches the problem from the ounce-of-prevention angle. Its JungSoft HDD Sheriff card takes preemptive measures against irreversible damage by monitoring and obstructing any attempts to change the hard-disk partition that holds the operating system and applications.



PHOTOGRAPH BY THOM O'CONNOR (TOP)



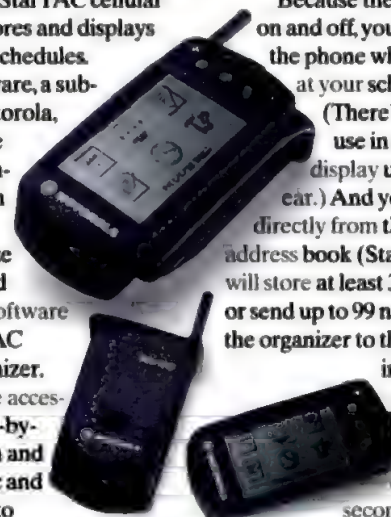
percent of respondents to a recent PC Magazine Online poll told us they've never used a 3Com PalmPilot since its debut three years ago. 15 percent are using their first one, and 7 percent upgraded along the way. Another 6 percent told us they tried but gave up. 35 percent of all respondents say they'll buy the next version.

A Cellular Piggyback Ride

Here's another spin on the smart phone. Motorola and Starfish Software have come up with a detachable organizer for the Motorola StarTAC cellular phone that stores and displays contacts and schedules. Starfish Software, a subsidiary of Motorola, developed the TrueSync technology used in the REX (a credit-card size organizer) and adapted the software for the StarTAC Mobile Organizer. The 2.3-ounce accessory has a 124-by-136 resolution and uses TrueSync and a serial cable to synchronize your contact and schedule information with Web calendars, Microsoft Outlook, Lotus Organizer, Lotus Notes, ACT!, Sidekick, Palm III, and REX

PRO. It works with any analog, CDMA, or TDMA digital StarTAC phone, but it doesn't work with GSM models.

Because the device snaps on and off, you can speak on the phone while you look at your schedule. (There's not much use in having the display up against your ear.) And you can dial directly from the organizer's address book (Starfish says it will store at least 3,000 contacts) or send up to 99 numbers from the organizer to the phone's internal storage. Motorola plans to sell the organizer in the second quarter of the year for about \$250. A combination package including the phone and Mobile Organizer will also be available, although pricing isn't yet finalized.



StarTAC Mobile Organizer. ▲

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Pentium III: What Can 500-MHz Do for You?

In this issue's cover story, we review the first seven Pentium III PCs. Join us online to compare their features and performance.

John C. Dvorak: Every Monday

Check in with our cantankerous columnist for his news, views, and snide asides about the Internet.

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Click Here for Free Apps

Just as network television offers free entertainment subsidized by advertising, the Web offers free software subsidized by advertising. Fledgling graphics developer NetStudio is one of the latest companies to experiment with free Web-based software services.

The company recently launched a version of its Web-graphics program, NetStudio, that doesn't require any training and doesn't need to be downloaded or installed. The software isn't a product in the traditional sense. Rather, it's a Web service that lets you create buttons, banners, headlines, and photographic treatments by going to www.netstudio.com. Because the software runs entirely on NetStudio's server—neither a plug-in nor a Java applet is required—there's no need to grapple with installation. There is one drawback: the online software contains only 25 percent of the functions found in the retail package, which you can buy for around \$100.

Paul Sonderegger, an industry analyst at Forrester Research, strikes a cautionary note concerning the business strategy. "The longevity and viability of this trend has yet to be determined. It's hard to see how these services are going to make money, considering that the [cost per thousand] for banner ads is dropping all over the Web." Ultimately, Forrester believes that to succeed, NetStudio must convert online usage into package sales.



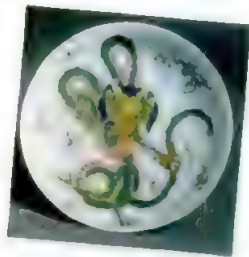
Art Appreciation

You may not associate the Internet with fine art, but recent innovations are bringing the two together. The Museum Loan Network (MLN) recently launched a Web site featuring art works from museums throughout the U.S. (<http://loanet.mit.edu/Web>). MLN hopes to increase art appreciation by enabling loans among museums.

Meanwhile, the Stanford University Digital Michelangelo Project may eventually preserve priceless works of art as 3-D computer models (<http://graphics.stanford.firenze.it/projects/mich>). Using advanced laser technology,

Chinese porcelain plate, Qing Dynasty (1644–1911).

scientists are able to digitize precisely the shape and surface characteristics of physical objects with every detail intact. The team is creating an archive of Michelangelo's sculptures and hopes to restore damaged works digitally so they can be viewed as they might have been in their original form.



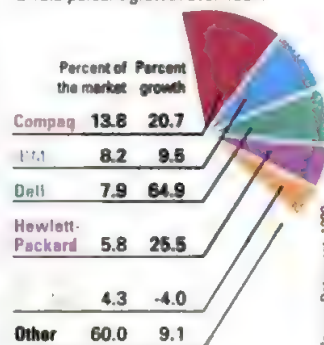
Business Is Booming

Despite radical cost-cutting and inventory problems at the start of 1998, it turned out to be another positive year for the PC market. A particularly encouraging fourth quarter indicates that double-digit growth may continue this year.

Preliminary figures from Dataquest show that market growth was 15.3 percent worldwide and 18.8 percent in the U.S. Compaq retained its number-one status on both fronts, and Dell showed a remarkable 64.9 percent worldwide growth and 60.9 percent U.S. growth.

The robust U.S. economy and the European replacement cycle helped drive sales, says Bill Schaub, vice president at Dataquest. He also attributes the performance to the industry bringing affordability and relevance to PC and Internet products for the home market.

PC COMPANY RANKINGS Global PC shipments topped 90 million in 1998, a 15.3 percent growth over 1997.



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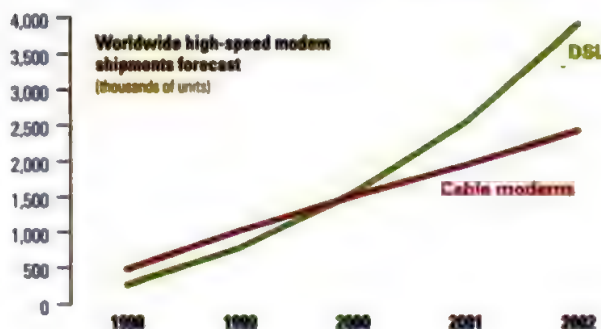
Source: PC Data, data for week of January 17 to 23.

Flip-Phone Frenzy

The digital phone market has reached a long-awaited milestone: Digital phone sales have finally surpassed analog phone sales, based on data from the first three quarters of 1998. Market researchers at Dataquest say total shipments of digital phones for 1998 should come in at 15.3 million units, and they predict triple-digit growth for digital phones for years to come. Between 1997 and 1998, sales of digital phones grew a whopping 170 percent. Part of the growth is attributed to new flat-fee pricing.

High-Speed Takeover

In the race for fast Internet access, cable modems are currently in the lead. Preliminary forecasts, however, indicate that sales of digital subscriber line (DSL) modems will overtake cable modem sales decisively by 2002.



THIS ISSUE'S CONTRIBUTORS: Carol Levin, Sharon Nash, Sebastian Rupley, Luisa Simone, Don Willmott.

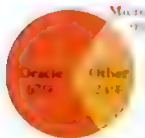
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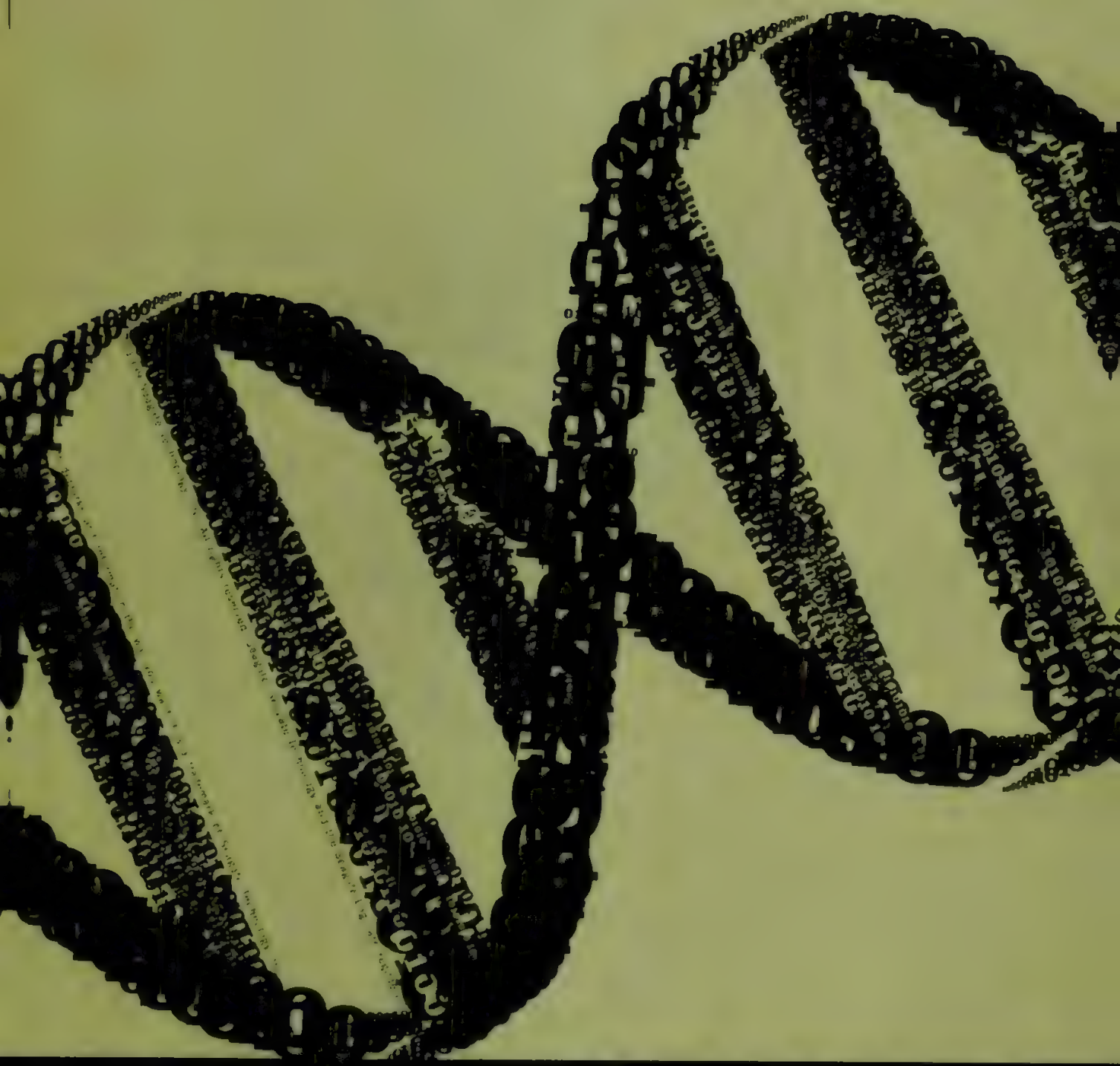


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A large, stylized graphic of a DNA double helix structure, composed of black and white segments, set against a light background. The helix is formed by two intertwined strands, with the segments representing the base pairs. The overall shape is a large, open loop, resembling a stylized 'G' or a partial helix. The segments are arranged in a way that creates a sense of depth and three-dimensionality. The background is a light, neutral color, providing a high contrast for the dark, intricate structure of the DNA helix.

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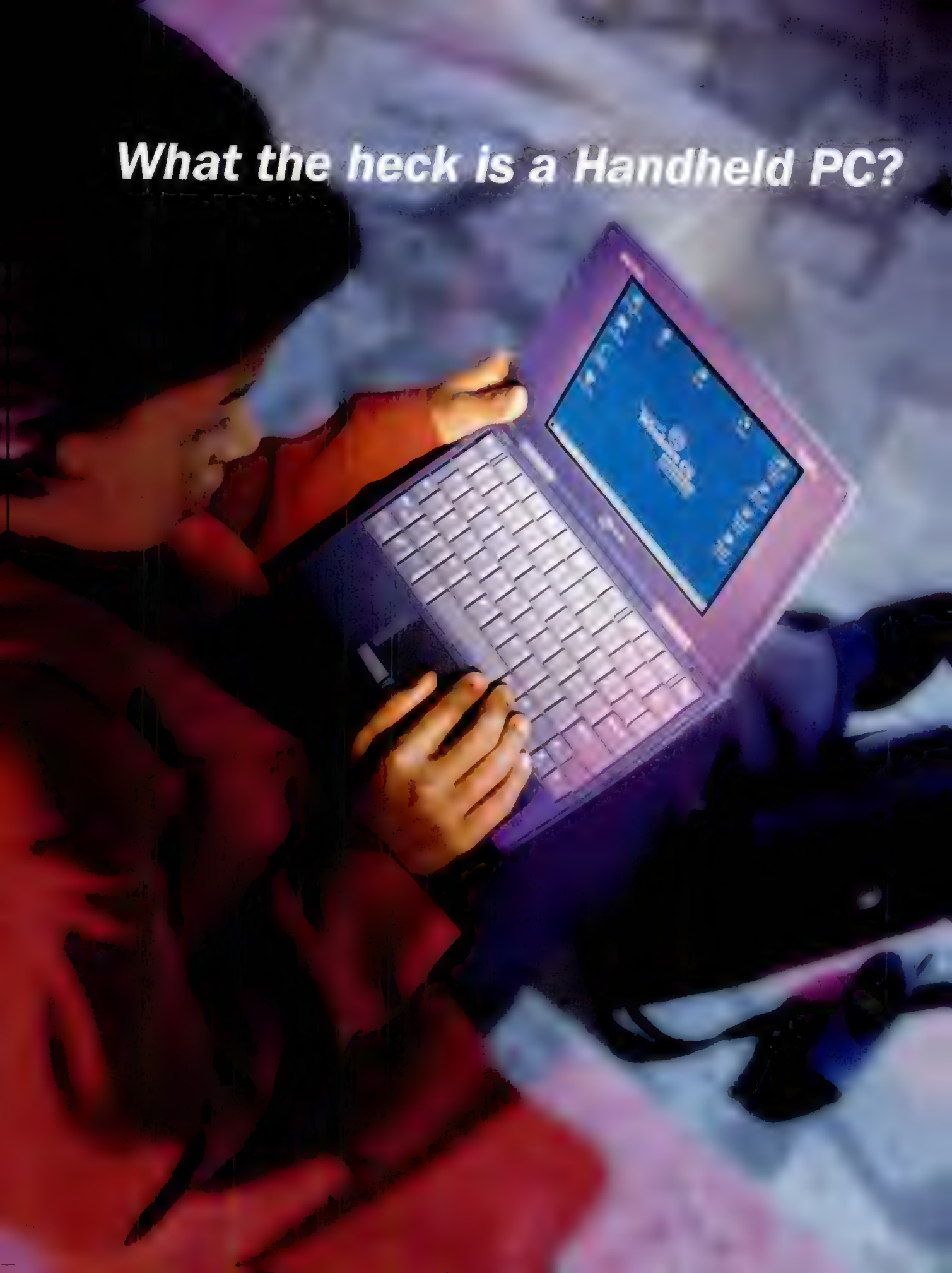


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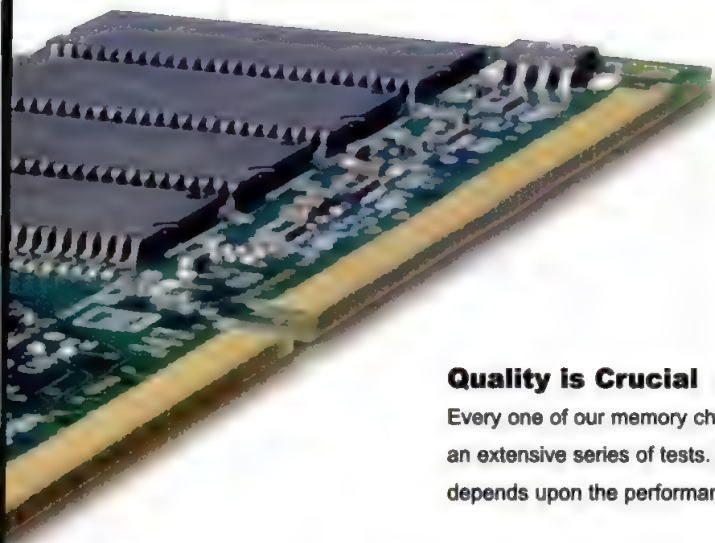
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LETTERS

TOP OF THE WEB TO YOU

Re "The Top 100 Web Sites" (February 9, 1999): As an educator, I spend a lot of time trying to find ways to make the World Wide Web more kid-friendly. It was the answer to a five-year dream to be able to have all my students on the Web simultaneously, though nothing is quite so daunting as to have 20 third-graders in 20 different places as they try to access the Web. I want my students to have the freedom to formulate their own questions as they begin the path to research and to the immeasurable amount of information available there. Therefore, I am delighted with a site you recommended, Ask Jeeves for Kids. My applause to the creators of the site and to you for including it.

G. GATLIN
via the Internet

No doubt it's easier to focus on the obvious, but the problem with your article is that it's too predictable to be very interesting or especially useful. Wouldn't it be more of a journalistic service to your readers to dig up some of the great stuff out there that they haven't already heard of? How about, next time, "The 100 Best Web Sites That Aren't Likely to Run Half-Time Ads on the Superbowl"?

SCOTT PETERSON
via the Internet

Michael J. Miller waxes poetic on the subject of the Web changing everything, but the portals you choose are all oriented to fun, family, or the individual. Shame on you for missing www.ceoexpress.com, far and away the best business portal there is. On top of that, you can get to the majority of your recommended search sites (except Google!, which is indeed a winner, and Northern Light) in automated fashion at www.dogpile.com. I learned of both these sites from a number of information professionals who sell sophisticated subscription-based Web search services to government and military types. They swear to Dogpile and CEO Express being the best of the freebies.

BILL DUNHAM
via the Internet

POINT AND SHOOT

Your comparative review of digital cameras is comprehensive and very useful ("Closing the Gap," January 19). I would like to offer some insight into what I consider a technical shortcoming in your evaluation of the test results. You fault the Fujifilm MX-700 and the Leica digilux for the yellow tint of their images and related flaws. It is apparent from the test images that the reason for these problems is not the intrinsic quality of the cameras' imaging systems but the combination of illuminations used in the test exposures. In almost all the other test exposures in

your review, the cameras' built-in flashes dominated the exposures; the ambient incandescent illumination contributed relatively little to the overall exposures. In the Fuji and Leica exposures, the cameras' metering systems judged the flash insufficient to make a proper exposure. This called for a slower shutter speed to allow the ambient incandescent illumination to dominate the exposures. The predominance of incandescent light caused the overall yellowish tint.

The slower shutter speed could also have degraded image sharpness via blurring caused by camera shake. That the Fuji and Leica exposures were dominated by incandescent light raises some valid concerns about these cameras (for example, is the built-in flash strong enough to be useful in most applica-

Wouldn't it be more
of a service to dig
up sites we haven't
already heard of?

tions?). But it is not right to fault the image quality of these cameras for this reason alone. I suspect that if you took a series of comparative test exposures in bright daylight, the Fuji and Leica cameras might fare much better.

TONY SPIELBERG
via the Internet

True, any image shot under incidental light or with a weak flash may pick up ambient color from the background or the light source. Every other camera was used under identical conditions and was able to set the correct exposure/flash combination automatically.—Ed.

I've been using digital cameras for the last three years and have taken over 2,500 pictures. Looking at your sample photos, I see how the rendition caused the results you printed. But you have to compromise, depending on how you want to have the camera render a scene. The bottom line is that you'll want to enhance or revise almost all pictures you take for some reason, once you get them into your photo-editing software. Here are my suggestions for reviewing these products in the future.

First, make the picture test more real-world. Set three pictures (using a 35-mm film SLR)—indoors, outdoors, scene—as your samples, then use the review digital camera and software to get as close to that as possible. Tell us what hoops you had to jump through to do it. Next, explain how the editing software uses file formats, and compare what is best. Hit those that use nonstandard formats and those

in which defaults can't be changed. Include downloadable benchmark tests for speed, resolution, and control. Regarding picture quality, give your teams a specific budget and let them find the best combination of camera, printer, and software. Keep up the good work.

DAVID WEBBER
via the Internet

PCs, NO

I read with interest Jake Kirchner's column titled "Conventional, Yes, Wisdom, No" (February 5). He makes the case that the foreseeable future of computing is centered on the PC. Kirchner reinforces his opinion

by pointing out that the

runners-up in this competition (the PalmPilot, WebTV, and so on) must become more like PCs by adding keyboards.

Gee, I wish it were that simple. We have had 30 years with the big all-purpose boxes on our desks that were supposed to simplify and enrich our lives.

Here's a news flash: For the average person, they have done neither. I for one am glad to see products on the

market that are fulfilling the promise that the PC made to us long ago. Today's new products are a success because they have a limited number of applications and do them well.

STEPHEN ORIN SIEHR
via the Internet

ALL YOU NEED IS...

I love the magazine. I love the Web site. I love companies that use their Web sites to extend their content rather than using them as electronic billboards for their products, services, books, or weight-loss programs. Great job.

BRADY MULLIS
via the Internet

YOU HAVE TO ASK

Bill Howard's column listing 20 questions that scream for answers should be reprinted in every issue of your magazine ("Twenty Questions," January 19). If a question finally gets addressed, another can take its place. The list reminds us of how much common sense and obvious functional needs are overlooked in hardware and software design. Well done, Bill!

GEORGE ROBINSON
Northampton, Massachusetts

Howard's 20 questions are excellent. Two more: Why doesn't Windows Explorer automatically execute a File/Refresh command when I change disks? And why can't my word



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[just ask goliath]

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4290

ES Galaxy 52MB Dual Port Solution 5370

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- Full Tower 300 Watt

2228

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1796

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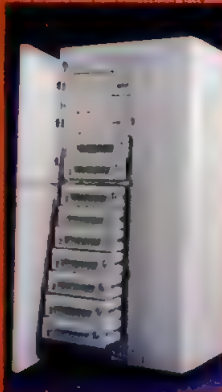
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3400

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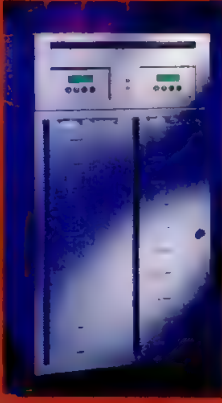
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WES DICK
Calgary, Alberta, Canada

DVORAK PUSHES (MORE) BUTTONS

I have enjoyed John C. Dvorak's columns over the years and believe "Nationalize Microsoft" (February 9) was right on point. An alternative would be to request that the philanthropic Mr. Gates donate 5 to 10 percent of his own net worth to fix Windows 95, 98, 2000, and so on. He is certainly not going to miss a few billion dollars; computer users might eventually get what they paid for (a stable operating system), and the world would be a happier place.

ROBERT D. MARPLE
via the Internet

While reading Dvorak's modest proposal, I had to keep checking the date to see if it was April Fool's Day. The irony was that his diatribe appeared in the same issue with "Netscape's Next Move" (Trends, page 28) and "Java 2: World-Ready" (Trends, page 29), each of which describes a development hanging poised and ready to strike like a dagger at the heart of Microsoft's core business. In this light, Dvorak resembles nothing more than a Dark Age alchemist proclaiming, "Here be dragons." I propose a solution of my own: Ziff-Davis is the leader in its industry and holds monopolies on several subindustry sectors, especially that of PC evaluation and testing software. It has set the bar so high that no other company can compete. For this reason I believe we should nationalize Ziff-Davis and make John C. Dvorak the nation's Microcomputer Czar. I'm sure that his forward-thinking ideas will have all industry problems solved in no time flat.

GEORGE COPELAND
via the Internet

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that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.

Corrections and Amplifications

In our story "PC Sound: Better All Around" (February 9), we stated that Microsoft's DirectSound3D instruction set lets developers manipulate up to 32 WAV files at a time. In fact, there is no limit to the number of simultaneous audio streams DS3D can support. In the same story, what we tested was Version 1.0 of Creative Labs' EAX 3-D audio technology. Version 2.0 is due out later this year.

In Bill Howard's column "Home Sweet Cyberhome" (February 9), the correct company name is UStec, not U.S. Technologies, and the company's URL is www.ustecnet.com. Also, the site is up, not under construction as we stated.

In our story "Print Servers" (January 19), we printed an incorrect Web address for Extended Systems. The correct URL is www.extendedsystems.com.

In Jim Seymour's column "Two More Win 98 Tips" (January 19), the URL for a prior column was misprinted. The correct URL is www.zdnet.com/pcmag/insites/seymour/js981030.htm.

In the story "PC-Based PBXs" (January 5), the telephone number we printed for Shoreline Teleworks was incorrect. The correct number is 850-837-1300.

Sing it, brother! I am a dyed-in-the-wool Republican, but being conservative has never meant supporting monopolies. Microsoft's unfair advantage is that it is practically impossible to market a new OS, because new OSs have little or no useful software. If a new OS cannot run Windows software, it cannot prevail against Microsoft.

Bill Gates deserves a great deal of credit for the things he has done for the industry. But the time has now come for a small amount of government intervention to allow fair competition in this market. A more elegant and fair solution would be to order Microsoft to license Windows 95 technology to other companies for a reasonable fee. This way, Microsoft could still sell Windows and make money from the licenses, but other companies would be able to create competitive operating systems.

ROB HRUSKA
Sacramento, California

On the basis of Dvorak's column, I am canceling my subscription to PC Magazine. Ads in your magazine touting X-rated Web sites are nowhere near as morally objectionable as this column. Whatever money I receive in refund, I will donate to the Ayn Rand Institute and the Committee for the Moral Defense of Microsoft.

RODNEY SCHROETER
via the Internet

A HAPPY MEDIUM

I've been looking at the Sony HiFD 200MB floppy disk drive, and I see what I consider a major flaw—not in the drive itself, but in the media. If I buy the HiFD, I have the choice of using a 1.44MB floppy disk, which costs next to nothing, or a 200MB disk for \$10 to \$15. This seems like an incredible span to me. What consumers need is a 10MB-to-20MB floppy disk that costs a dollar. Most programs would fit, and if necessary, a program could be split over two or three disks. More than that and the 200MB floppy disk would come into play. The key advantage of such a floppy disk is the price. I would think nothing of handing a \$1 disk to someone, but I would think twice about

handing over a \$10 disk. I believe a medium-size floppy disk would be a big seller.

ROBERT HILL
via the Internet

USER TO USER-FRIENDLY

For ten years now, one of the first places I have turned to in PC Magazine has been the User to User column. Sal Ricciardi's tip on deselecting "Log on to network" in the DUN properties for my ISP is a perfect example of why (February 9, page 215). Thanks to Ricciardi for the tip, and thanks to you for continuing this forum. Now if only someone would make Lotus Notes comprehensible to a layman....

H. STEVENS
via the Internet

I had a problem with my Internet connection for months and couldn't figure it out. The techs and my ISP were unhelpful. (I am planning on switching to cable as soon as my cable company offers it.) In the User to User section of your February 9 issue, you printed a fix for slow Internet log-ons. Well, I tried it, and it worked!

CARY FOY
via the Internet

THE TIPS KEEP ROLLING IN

Jim Seymour has the right idea about desktop shortcuts ("Two More Win 98 Tips," January 19). I much prefer the easy access afforded by the use of the Start menu. I nest shortcuts in folders, which puts them in nice, neat groups rather than forcing the user to search through one humongous list extending off the screen. To do this, right-click the Taskbar, outside any tasks; select Properties and the Start Menu Programs tab; click Advanced; make one or more new folders under the Start Menu; make shortcuts (by selecting items from the right pane), and place them in the desired folders. The lists and sublists will then appear at the top of the Start Menu. This works in Windows 95 and 98, and it sure beats navigating through the regular Start Menu paths or minimizing all open applications in order to find a desktop icon.

ERIC L. VAN DUSEN
Pasadena, California



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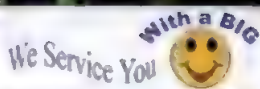
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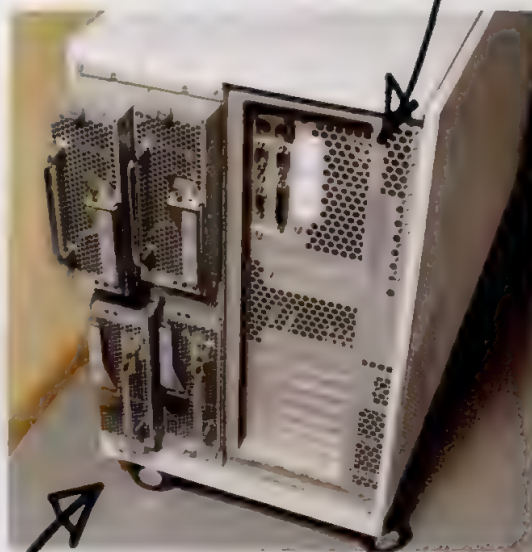


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Microprocessors are set to play a bigger role in the security arena.

Do you want your microprocessor talking about you behind your back? The trend toward building user-ID technologies into microprocessors—designed to provide a numerical ID, say, when you make an electronic transaction on the Web—is accelerating, and privacy groups are up in arms. (See Bill Machrone's and John C. Dvorak's columns in this issue.)

Intel recently got into trouble with privacy groups, because of the Pentium III's unique processor-identification number that is used to track and validate e-commerce transactions (see "Pentium III Hits 500" in

cently, and there are likely to be many other security features incorporated into Intel chips that could draw the ire of privacy groups. "In meeting with many corporate IT managers, we see an incredible amount of concern over the security solutions that are being deployed and whether they're strong enough," said Pat Gelsinger, vice president of Intel's desktop

strong as the foundation it's built on, and hardware resists tampering."

Intel and RSA have agreed to extensive product development and a cross-licensing plan to enhance the security of Intel products over the next three years. RSA's Crypto-C and Crypto-J encryption software solutions are to become key parts of Intel's microprocessor efforts.

Intel



this issue for reviews of the first Pentium III systems). The number helps identify the owner of a chip for a Web site when a transaction takes place and assists Intel in tracking stolen chips. The ID is a 64-bit number within the chip's wiring and is designed to create a 96-bit unique serial number, accessible by software, to identify users. Intel has also produced a software utility designed to let users erase their ID numbers, but that wasn't enough for some privacy groups, including the Electronic Privacy Information Center and the American Civil Liberties Union.

In response to backlash, Intel scaled back its effort and decided to make the ID's use voluntary. New Pentium III systems will ship with the feature disabled, but customers can turn it on if they want. The topic was a hot one at the recent RSA Data Security Conference. Building security features into microprocessors may be a big benefit to corporations and the software industry, because the copying of software could be policed through IDs built into chips. It raises many questions about the role of hardware in security schemes, however.

Intel has made security into a battle-cry re-

products group, in his keynote address at the conference.

"And as these IT managers bring their intranet environments out, they want to know that they're truly secure. We've seen fundamental flaws detected in the implementation of a variety of security algorithms and solutions as they've been deployed, which attacks the fundamental premise by which the new connected world is being delivered."

Gelsinger is adamant that security solutions for enterprises cannot stay restricted to software. "Hardware improves trusted software for security," he said. "Security is only as

isn't alone in bringing security and microprocessors together. Advanced Micro Devices is evaluating technology similar to Intel's, though it's not clear yet how it might be implemented. National Semiconductor is working on similar technology as well. Privacy groups are expecting conflicts—similar to the one that arose with Intel—surrounding other electronic ID technologies that may make their way to microprocessors, such as digital-signature technology.

Washington is waking up to the privacy issue as it relates to microprocessors and beyond. Congress is reviewing dozens of high-tech, privacy-related bills, several of which are expected to take shape this year. Some of the bills take on issues such as e-commerce privacy and encryption. Several privacy groups, including the Center for Democracy and Technology, are working with legislators on the upcoming bills.—Sebastian Rupley

Pentium III Police

By building serial numbers into Pentium III chips, Intel can track stolen chips and add an extra layer of security to e-commerce transactions. Here's one possible scenario. A user with a stolen credit card number attempts to buy an item from a Web store, which then tries to authenticate the user but finds a mismatch between the CPU's serial number and the credit card number. The Web store refuses to complete the transaction and notifies the stolen credit card's owner of the unusual activity. Privacy groups contend that use of the serial number is potentially an invasion of privacy.



ThinkPad Tracking

With companies losing millions of dollars every year in portable computing equipment, keeping track of your notebook (and the valuable information inside it) grows more important all the time. To address this problem, IBM recently started shipping its ThinkPad notebooks with Asset ID, a security technology designed to protect your company's portable valuables.

Asset ID combines a radio frequency (RF) ID tag and a hand-held RF scanner to read and store information about the ThinkPads in a company's inventory, even if the notebooks are unplugged or in cartons. If a notebook is removed without authorization through a door or passageway protected by an RF sensor, the ThinkPad automatically becomes password-protected. Security personnel can scan notebooks against the ID cards of the people carrying them to detect inappropriate use. They can also shut off the notebooks remotely as soon as unauthorized use becomes evident.

Currently, Asset ID is available only in the IBM ThinkPad 770Z (starting at \$4,799 list) and the 600E (\$2,999), but IBM plans to add the technology to future notebook



computers. To take advantage of the new system, companies will have to develop protected environments. This will require the installation of internal antennas, door portal systems, and hand-held scanner devices. Asset ID

cannot be installed in earlier IBM ThinkPads, however.

As an alternative security measure, IBM has also announced the Smart Card Security Kit, which contains security software, a smart card, and a smart-card reader that can be installed in a notebook's Type II PCMCIA slot. To disable access, you remove the card. The kit enables password protection, data encryption and decryption, and confidential e-mail with digital signatures. So even if someone steals the computer and discovers the password, the thief won't be able to access the information, because the encryption key is found only in the smart card.—*Sharon Nash*



Graphics Cards: A Little Means A Lot

PC LABS A difference of 5 percentage points on a benchmark test score might not sound like a big deal, but it can be. In the highly competitive graphics accelerator business, a few points either way on our tests could mean the difference between winning or losing a multimillion dollar contract with a major PC maker. While we're flattered that our tests matter so much, it also means vendors push the envelope to get us their latest, best-performing products in time for our big roundups.

Such was the situation with our fall roundup of graphics accelerators ("Who's the Fastest?", December 1, 1998). We followed up by purchasing the best performers at retail, to see how the vendor-supplied cards in our story compared to cards customers would purchase. As we suspected, the new round of testing uncovered some discrepancies with our original data.

For example, the Diamond Viper V550 and the ELSA Erazor II that we purchased at retail had slower clock settings for their nVidia RIVA TNT chips than ones that Diamond and ELSA provided to us. A faster chip or memory clock can make a difference in performance, and some graphics board vendors and PC system vendors originally intended to include the slightly faster clocked TNT chips in their high-end products. But nVidia was unable to produce the higher-speed part in volume, so most TNT boards on the market are running at the slightly lower speed today. As a result, the retail Viper and Erazor performed a few percentage points lower than the original ones tested.

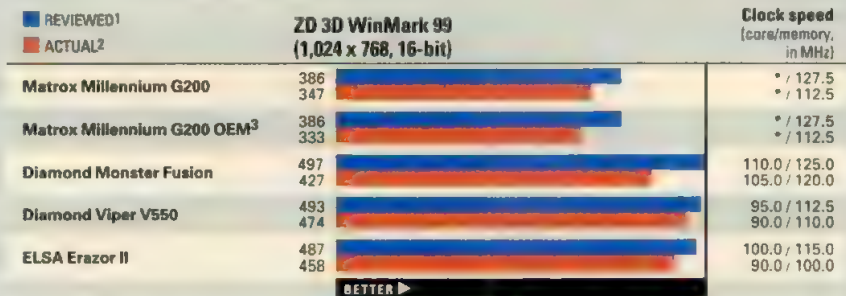
Another notable discrepancy occurred

with the Editors' Choice-winning Matrox Millennium G200 accelerators. Matrox sent us two boards, both clocked at 127.5 MHz. But we were unable to find such high clock rates for the SGRAM-based boards at retail, which were clocked at 112.5 MHz. (We used Entech Taiwan's PowerStrip utility to test memory clock timings for the G200. You can download PowerStrip from the Web www.entehtaiwan.com/ps.htm.) When we asked Matrox the reason for the discrepancy, the company said it had a limited number of production level "Rev C" G200 components available in late August, which were included in the products sent to PC Magazine Labs as well as to certain PC system manufacturers, and that it was still shipping "Rev B" products to retail stores through November.

Though some cards were configured differently in their retail versions, we found another problem just as disconcerting: Some products weren't available when our story hit the street in mid-November—a review requirement. The SDRAM version of the Hercules Terminator Beast AGP was available, but the faster SGRAM version that was submitted for our review wasn't shipped until late December. And the Diamond Monster Fusion cards weren't available in stores until more than a month after the story was published. Diamond claims that limited supplies were shipped to retail and immediately sold, but we called all the retail and mail-order outlets recommended by Diamond to no avail until late December.

PC Magazine Labs is currently investigating review methods that will help prevent such problems from occurring in the future.—*Nick Stam*

DISCONCERTING DISCREPANCIES The graphics accelerators PC Magazine Labs received from vendors for our December 1998 roundup ran faster than the retail versions of the same accelerators. We traced the causes of the discrepancies and found some answers.



(1) December 1, 1998 (2) Retail card with current Web driver (3) Available wholesale to PC manufacturers * Info not available

INTERNET

The Urge to Merge

When Yahoo! announced plans to acquire GeoCities for \$3.58 billion in stock recently, industry analysts stopped to think. With the many portal sites consolidating into a few major players, who's going to come out on top? And do stubbornly independent companies stand any chance at all?

In the recent past, AOL and Netscape joined forces, Disney created the Go Network (and combined it with Infoseek), and Microsoft began pushing MSN with all its might. These moves indicate that few Internet companies dare to go it alone amid the fierce competition for huge audiences and revenues.

Analysts predict that the consolidation trend will continue. "There seems to be a sense of urgency among the major players



that size matters. If you can point to a big audience, you have an edge," says Peggy O'Neill, industry analyst at market research firm Dataquest.

At first, Internet portal companies were eager to acquire sheer numbers to impress advertisers. Now they're realizing that random surfers aren't nearly as valuable as return viewers who feel loyalty to particular portals.

The question remains whether there will be room for more than a few players in the fast-consolidating portal market. "There is enough room for several different portals on the

Web," says Anya Sacharow, an analyst at Jupiter Communications. She adds, however, that online communities will have to move from focusing on acquiring customers to working on generating revenues in order to survive and prosper.

Meanwhile, Lycos and USA Networks recently announced a merger despite Lycos's repeated claims that it would stay independent. The new USA/Lycos Interactive Networks will combine Lycos with USA Networks' e-commerce units—Ticketmaster Online/CitySearch and the Home Shopping Network.—Sharon Nash

Speaking Freely, or Not

Americans have been zealous about freedom of speech since colonial times. So why is it that in the 200-plus years since we enshrined it in the Constitution's Bill of Rights, we still haven't figured out what free speech means? One big reason for the continuing controversy: the Internet.

Today even free-speech tenets that have been widely understood and accepted are once again up for debate and litigation, thanks to the Web. For example, until recently most people understood that pornography would exist, but most were comfortable with the thought that children's access would be restricted. Americans generally are happy to let anyone state a public opinion, but we've taken it for granted that doesn't mean people should be allowed to incite crowds to riot or abet murder.

However, now anyone, of any age, who has an e-mail address, is subject to enticement for hard-core sex sites on the Web. If your 6-year-old enters *baby doll* in any search engine, she'll get links to sites you definitely won't want her to visit. If this is free speech, it's very aggressive free speech. Most of us wouldn't want this stuff coming into our U.S. mailboxes, but many of us are unsure about how—if at all—it should be regulated online.

Congress and the judiciary aren't any more sure how to resolve these issues. One recent example: For the second time, an online censorship law has been stopped before it could take effect. Last month a federal judge ruled against enforcement of the Child Online Protection Act (COPA). The case is continuing, but the judge has clear-

ly sided with COPA's opponents, who argue that the restrictions will interfere with adults' right to view nonobscene materials.

The ruling is similar to a 1997 Supreme Court decision striking down the Communications Decency Act on the same First Amendment grounds. In both cases, the courts said the acts' exceptions for artistic or scientific material just weren't broad enough, and the threat to free speech was just too great.

Of course, not every issue of free speech online concerns porn. On the Web, there's hate material from extremist groups of every stripe. And according to one court, there's unacceptable, threatening material from abortion foes. Recently, an Oregon jury ruled against an antiabortion Web site containing pictures and personal information (addresses, auto license numbers, and so on) of doctors who perform abortions.

Despite these rulings, these issues aren't going to be resolved with a few court decisions. Frustrated COPA supporters in Congress have introduced new legislation. And the antiabortion forces in the Oregon case vow to continue their fight in court, on the streets, and online.

Personally, I think it makes sense that pornographers shouldn't have any readier access to our children online than they do offline. And hate or threatening speech that isn't protected in other public forums shouldn't be protected online. Given the inability of legislators to craft laws that extend traditional free-speech guidelines and protections to the Internet, we're going to need far better means of filtering our Web travels and transactions than we have today. In the meantime, the courts will be busy sorting out these issues one at a time.



Jake Kirchner



Nokia 446Xs



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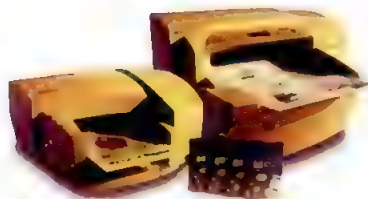
The Nokia 446Xs is a perfect example. This sleek 19" monitor (17.8" VIS) delivers up to 1600 x 1200 resolution, up to 90Hz refresh rate at 1280 x 1024, with a .22mm horizontal dot pitch. It's a short neck CRT for a smaller footprint, but it saves considerably more than desk space.

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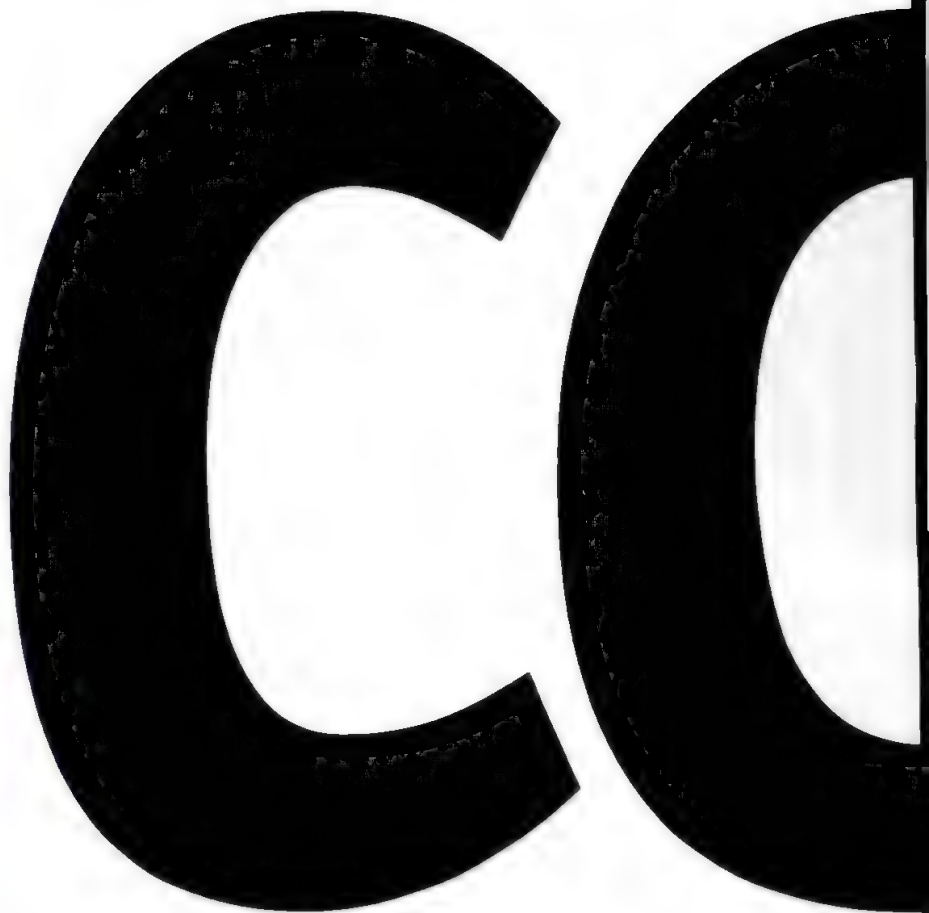


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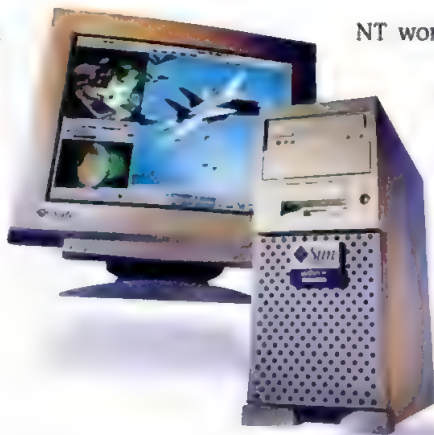
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High-Bandwidth Options: ADSL vs. Cable

After a long wait for high-speed Internet connectivity, many home and small business users will have two alternatives this year: ADSL (asymmetric digital subscriber line) and cable. That's good news, but it means making yet another bet on an emerging technology and possibly replacing your current ISP with either the phone or cable company.

In order to compare both connections, we installed BellSouth.net's FastAccess ADSL service and MediaOne Express's Cable Modem Internet Service and ran them through their paces. Because the availability and pricing of cable and ADSL service varies widely by geographical region—even by neighborhood—your experience will vary. Here's what we found at our test locations in Atlanta.

PRICE/FEATURE SET

The MediaOne Express service costs \$39.95 per month for current cable customers and \$49.95 otherwise. Monthly payments include lease charges for the cable modem, so you don't have to buy it up front. You'll pay an extra \$49 if you don't have an Ethernet card.

Subscribers receive up to five e-mail accounts and 10MB of storage space for personal or commercial home pages. You can share the service among several computers on a local area network, though MediaOne doesn't provide the equipment or the necessary software.

In contrast, BellSouth.net's ADSL service costs \$59.95 per month, or \$49.95 for preferred Complete Choice customers. Start-up costs include \$199 for the modem and network interface card and \$99 for the installation. The service includes one e-mail address but no server space, and you can't share the connection over a network—a significant drawback for small businesses.

Both services are always on, so connection delays are eliminated. Although both services can be used only at the point of installation, BellSouth provides a dial-up connection with its service, a convenience if you need to access the Web from several locations.

INSTALLATION

Both installations were very professional, with a slight convenience edge going to ADSL. BellSouth made and kept an 11:00 A.M. appointment, and the technician installed the Ethernet card, attached the ADSL modem, and configured the TCP/IP settings in under an hour. (The future version of ADSL, known as DSL Lite, won't require a service visit.) We completed the installation online.

MediaOne schedules installations within 3-hour windows (8:00–11:00 A.M. in our case), and the technician arrived at 10:00 A.M. Though the home already had MediaOne

cable TV service, the technician had to run new cable from the street, consuming much of the 2-hour visit. The installation of the network interface card and modem as well as the TCP/IP configuration went smoothly, but we had to call MediaOne to configure our e-mail accounts, because we couldn't set them up online.

PERFORMANCE

Both services advertise a 1.5-Mbps downstream transfer rate. The ADSL offering has a 256-Kbps back channel; the cable offering has a 300-Kbps back channel. We tested downstream transfer rates, downloading three files from three different sites: a 6.3MB MP3 file from www.mp3.com,

a 2.4MB download from www.microsoft.com, and a 1.7MB Daily Download from www.pcmag.com. We also tested a single-line ISDN modem and a 56-Kbps modem connecting at 41.3 Kbps. Although results will vary among product offerings in different locations, here's what we found.

The ADSL connection ranged from 50 to more than 100 percent faster than cable. This may be due to the fact that cable uses a ring topology, which shares total bandwidth among modems; DSL is a dedicated, single-user connection. Both connections far surpass existing modems, however, downloading files

15 to 30 times as fast.

LOCATION, LOCATION, LOCATION

Your first shopping step is to find out which service is available in your area. The best place to start looking for availability is the Web site of your phone company and local cable service provider. In general, ADSL is more accessible, the result of it running on existing copper phone lines. In contrast, most existing cable installations can't handle Internet connectivity without an upgrade. And expansion into commercial areas not currently supporting cable TV will be very slow, reflecting cable's consumer focus.

When widely available, cable's price and features will be compelling to consumers, although those with a real need for speed may want to consider ADSL. And with cable unavailable in most commercial areas, ADSL may be the only affordable high-speed alternative for small businesses. Though one ADSL connection is affordable, supporting multiple users could quickly become cost prohibitive, nudging many small businesses back to shared ISDN routers and similar lower-cost solutions.—*Jan Ozer* 

ADSL

- 1.5-Mbps downstream, 256-Kbps upstream
- Runs on current copper phone lines
- \$300 start-up cost
- \$80 monthly cost
- Not networkable
- Rapid nationwide deployment

Cable

- 1.5-Mbps downstream, 300-Kbps upstream
- Speed degrades as neighbors access cable
- May require cable upgrade
- \$40 to \$50 monthly cost
- Networkable
- Limited access in commercial areas

Speed Demons

On tests measuring the top speeds of file downloads, our ADSL Internet connection beat our cable connection, but both high-speed alternatives far surpassed both the 56-Kbps modem and ISDN line.

High scores are best. Low scores are best. Bold type denotes first place	6.3MB MP3 file		1.7MB file*		Download time (min:sec) ▼	
	Top speed (KBps) ▲		Top speed (KBps) ▲		Download time (min:sec) ▼	
56 Kbps	4		4		23:13	6:45
Single ISDN (64 Kbps)	7		7		16:17	4:32
Cable (1.5 Mbps)	62		46		1:34	0:32
ADSL (1.5 Mbps)	127		85		0:45	0:17

* PC Magazine Online's Daily Download



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*Weight may vary based on configuration **Call 1-800-GATEWAY or write to us at Gateway Terms & Conditions, P.O. Box 1951, North Sioux City, SD 57049-1951 for a free copy of our limited warranty. On-site service not available for Solo portable products.

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(Pictured here: Solo 2500, 13.3" Display, 7.1 lbs.*)



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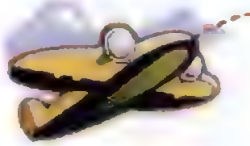
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Business Travel



By Don Willmott

The e-commerce revolution was begun in great part by the travel industry—and why not? An online reservation request is really nothing more than a simple database query followed by a little back-and-forth communication. Everybody's booking online these days, so much so that online travel will be an \$11 billion business by 2002. If you have a good idea of what you're looking for, there's no reason to involve a travel agent or your corporate travel office, unless your company forces you to go that route. Once you've taken care of your plane ticket, here are some other business-travel tasks that the Web can help you accomplish.

Make Hotel Reservations

► The first decision you have to make is whether you will head for hotel-chain Web sites or start with a broader travel site. If you're loyal to a particular hotel chain, you can head straight for its site, where you may encounter last-minute deals if you're traveling on short notice. The obvious advantage of a travel site is price comparisons. As its name suggests, **Biztravel.com** (www.biztravel.com) has the best features for the frequent business traveler, most notably an extensive profile that you can fill out to make sure the system knows your priorities. It is also the best site if you want to track hotels' "frequent-sleeper" programs.

Rent a Car

► Many business travelers don't have a choice in car rentals; their companies have contracts with specific agencies. If you do have the chance to shop around for the best prices, do it at one of the big travel sites. **MSN Expedia** (www.expedia.com) is particularly effective at helping you compare prices, and it covers the U.S., Canada, England, and Australia. **Travelocity** (www.travelocity.com) and **Preview Travel** (www.previewtravel.com) get you to a reservation in the fewest number of clicks. The big two agencies, **Avis** (www.avis.com) and **Hertz** (www.hertz.com), have sites that offer rentals all over the globe, even in places where you probably would not want to drive. Both sites have special services and deals for their frequent renters. Other large rental agencies, such as **Alamo** (www.goalamo.com), **Budget** (www.drivebudget.com), and **National** (www.nationalcar.com), also let you place a reservation online.

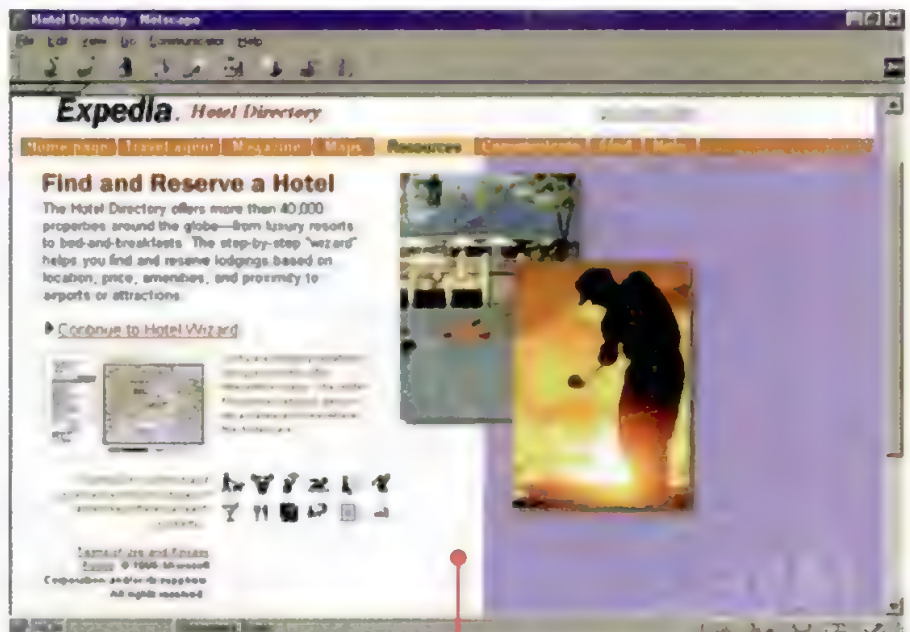
Track Frequent-Flier Miles

► Biztravel.com has a feature that lets you track multiple hotel and airline mileage accounts, though we've noticed that some airlines, including **American Airlines**, no longer allow Biztravel.com to access their frequent-flier data. One cool feature: The site lets you set award thresholds for each airline, so the reservation system can prioritize around flights that will get you toward your mileage goals. You can also visit the sites of the airlines to which you are most loyal.

letting you see your mileage statements online. Unfortunately, airlines have been slow to let you use their sites to claim awards. American, for example, will let you request an award certificate online, but then it sends the certificate to you via snail mail.

Get City Information

► If you have only a minute to get an idea about a city, start with a city guide at a Web portal. **Yahoo!** (www.yahoo.com), for example, has 12 U.S. city guides, each of which features local yellow pages, directories of restaurants and events, news headlines, and so on. **Excite** (www.excite.com) is even better. It has hundreds of U.S. city guides featuring preselected sites that offer good information, and the local weather report is always right at the top. With Expedia as one of its major components, **MSN.com** (www.msn.com) is also rich with international city and country guides and maps. You'll also find phrase books for close to 50 languages. One of the Web's most useful travel resources is **Lonely Planet Online** (www.lonelyplanet.com). Lonely Planet's guide books are among the best in the world, and having free access to much of the information online is great for finding something interesting to do once you arrive and get your business out of the way.



American (www.aa.com) customizes its site with your preferences, and every screen shows your current mileage balance. **Continental Airlines** (www.flycontinental.com), **Delta Air Lines** (www.delta-air.com), and **United Airlines** (www.ual.com) all do a good job

If your company lets you pick your own hotel when you travel, a service like MSN Expedia's Hotel Guide, which has 40,000 listings, will let you be very specific about your preferences as you home in on the perfect hotel.



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*Price is estimated street price. Actual price may vary. Monitor not included. Intel, the Intel Inside Logo and Pentium are registered trademarks of Intel Corporation. ©1999 Hewlett-Packard Company. All rights reserved.

A computer mouse is shown from a side profile. Instead of a standard button, the left button is a human finger, which is brown and has a realistic texture. The mouse is white with a grey cord. The background is white with a few small brown specks, suggesting a cave or a simple surface.

A few million years ago, in a cave lit by dim sunlight,
man first marked his presence in the world.

Announcing his ambition using flesh and earth.

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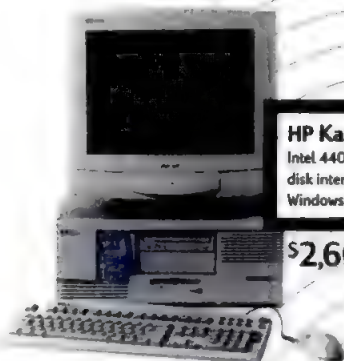
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\$791***HP Kayak XA-s PC Workstation** Supports up to two Intel Pentium II processors at 400 MHz

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\$2,607***HP NetServer LPr** Intel Pentium II processor 400 MHz with 512 KB cache

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\$2,867***HP OmniBook XE Notebook PC** Intel Pentium II processor 266MHz with embedded L-2 cache 32 MB SDRAM

4.1 GB hard drive • 12.1" SVGA TFT screen (6 million colors) • Built-in 56 Kbps v.90 compatible modem • 3.5" 1.44 MB drive • 24x max. CD-ROM drive • 128 bit graphics accelerator • Dual Display capability • Windows® 98 • DMI 2.0 compliant • Model F1720WT

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By Jan Ozer

Thankfully, help is on the way in the form of online calendars. These tools combine the best elements of PIMs, groupware, and a social secretary to do far more than a standalone PIM or paper-based organizer ever could. Here, we review six such online calendars—a diverse set of tools targeted at road warriors, corporate

Oh, did we mention that these sites are all free, and that most let you synchronize your online information with your PIM or Palm device? In general, these sites provide a new range of functionality that's bound to appeal to a broad range of users.

A competent online PIM with strong group capabilities, Jump! (www.jump.com) is trying to be all things to all people, and this breeds a slightly complex interface, exacerbated by bandwidth-hungry bitmaps. Still, Jump!'s functionality makes it the best choice for the well-connected Net-citizen to track personal and group activities online, and it's also a good choice for groups seeking an online presence.

contains scheduled activities, a to-do list, and a summary of e-mail, group, and planning activities. Third-party content includes horoscopes, local weather, and TV programming—with more coming. From the Today page, you can move to the calendar, e-mail, contacts database, tasks list, or group manager.

Most of Jump!³’s PIM-oriented features were competent, with many highlights, such as birthday and anniversary fields in the contact manager, with e-mail reminders. By the time you read this, the mail program should consolidate mail from other POP3 accounts, though this wasn’t working during our tests.

We did successfully synchronize our database with Outlook 98. ACT! and Lotus Organizer compatibility are also available, and Lotus Notes, Schedule+, Sidekick, Windows CE, and PalmPilot compatibility should

CompuServe 2000 hits the Web (and the mainstream) with a little help from AOL. *Page 53.*



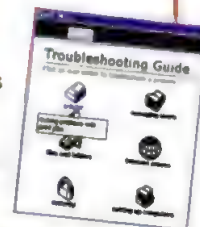
In exchange for your demographic information, Net-

Zero lets you surf for free. Is it worth the banner ads?

Page 66.



Once again, Microsoft tries to serve up everything a small business network needs. Read about our peek at the public beta version of Microsoft BackOffice Small Business Server 4.5. *Page 76.*



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www.pcmag.com

FIRST LOOKS

also be available by the time you read this.

Jump! supports three types of groups: open (anyone can join), public (new users must ask to be admitted), and private (by invitation only). To create a group, you select a name, designate whether it's private, public, or open, and then invite members to join.

Groups have their own home page with calendar and message board, where members can view or schedule events with workgroup-friendly features such as a conflict-resolution tool. Members are automatically notified of new meetings, which they can accept or reject, with return notice sent to the member calling the meeting. Accepted meetings automatically appear on the member's Jump! schedule.

This feature set is great for workgroups, but since you can't view other members' schedules, it's not ideal for road warriors seeking to coordinate their



Public or private, you can elect to let others view your calendar, add events, or both.

The only event that you can add to your own calendar is an appointment, which can also be

through sister site Tripod.com, perhaps a great branding exercise but confusing to users unfamiliar with Lycos' other properties. Finally, though Outlook 98 and Palm device synchronization are coming, they won't be available for the beta release.

In general, MyTime.com lacks most features offered by other calendar sites, so its success depends on content, and there was little of value during our review. But the combination of MyTime.com's usability and Lycos' marketing muscle makes this site one to watch.

Jump!
Jump Networks Inc.,
Ithaca, NY; 607-277-8700;
www.jump.com
410 at www.pcmag.com/info/inf

RSVP: When you create a group event, Jump! checks for scheduling conflicts.

schedules with administrative help back home. Jump! lists all public and open groups on its site, a valuable marketing tool for groups seeking members.

Unfortunately, Jump!'s interface is a liability, overflowing with colorful bitmaps that fill in oh-so-slowly at 28.8 Kbps, undoubtedly contributing to the site's general unresponsiveness. That said, many users will brave the interface to access Jump!'s strong group features and comprehensive PIM functionality.

MyTime.com

Lycos' MyTime.com (www.MyTime.com) personal Web calendar eschews most PIM and group organizational tools in favor of a simple, elegant framework for viewing personal and multiple event calendars. But with scant content and no e-commerce links, the pre-beta version of MyTime.com (which we tested; the service is now in public beta) was several evolutionary steps behind When.com, its closest competitor. Given Lycos' resources, however, this work in progress should mature rapidly.

MyTime.com's basic building block is the calendar, which can be public or private. Public calendars can be viewed by anyone, but only designated Friends (who must be registered MyTime.com users) can view private calendars.

public or private, allowing you to hide details even on public calendars. In addition to date and time information, you can add bitmapped images, messages, and URLs to the appointment, a unique and useful feature.

Organizations create their own calendars, which MyTime users can search for by keyword and category and add to their personal calendars. Once you add the calendar, you use a checkbox to view and hide the schedule. This lets you grab the schedule for your favorite sports team or band, toggle it on to check a few dates quickly, and then toggle it off to remove the clutter—great way to manage multiple calendars.

Unfortunately, not all of MyTime.com's features were similarly elegant. MyTime.com won't let you specify your own password when you sign up; rather, it assigns and e-mails a password you can later change, adding an unnecessary hassle. You also retrieve lost passwords

ScheduleOnline

Ideal for organizations needing to manage their people, places, and things, ScheduleOnline (www.scheduleonline.com) is fast and highly functional. With no event links, however, the site can't help expand your social



MyTime.com
Lycos Inc.,
Waltham, MA; 781-370-2700;
www.MyTime.com
411 at www.pcmag.com/info/inf

BEEHIVE YOUR DAY MyTime's calendars are designed for public consumption, with useful features such as graphics and Web links.

calendar, nor does it provide any marketing opportunities for groups that are looking for new members.

ScheduleOnline's work metaphor centers around the organization. The administrator names members and identifies resources such as meeting rooms and shared company cars. The administrator can also create departments and groups, which facilitates scheduling multiple members into a meeting.

PC EDITORS' HOT LINKS

www.pcmag.com/hotlinks

Go online to find out Editors' Hot Links to all the features in this issue.

eCircles

www.ecircles.com

If you organize family reunions more often than board meetings, eCircles offers a family-friendly site to share baby pictures and plan events.

Internet Mail Consortium

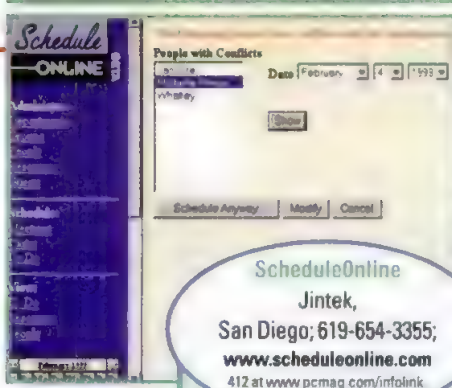
www.imc.org/pdi

This site contains all you need to know about the vCalendar specification, including a list of vCalendar-compliant applications.

Time Service Department

<http://tycho.usno.navy.mil/what.html>

Synchronize the clock on your PC with "the country's official timekeeper," the Master Clock facility at the Washington Naval Observatory.



All group members can create three types of events: meetings, tasks (which are time-based and can involve resources), and to-do items (essentially free-form items that don't involve resources or specific time slots). All items appear on your calendar, which offers the standard daily, weekly, and monthly views.

ScheduleOnline excels at resolving conflicts for meetings and resources. When scheduling a meeting, the site automatically checks the schedules of all invitees and the availability of requested resources, such as conference rooms. The program identifies members with conflicts and lets you view their schedules to identify better time slots. ScheduleOnline will also send reminders via e-mail if you choose.

You can ignore the conflicts and schedule the meeting or choose another meeting time. Either way, the site automatically e-mails all invited members, who can accept or reject the invitation online. You can also easily see who has confirmed or declined, another nice feature. Any member can also invite nonmember guests, who can view a schedule but can't create meetings, tasks, or to-do lists.

The interface is largely text-based, contributing to its blinding speed. Also missing is the clutter of e-commerce links, weather reports, and horoscopes, resulting in a slightly ascetic look, but the site is highly usable, even on low-speed connections.

In terms of shortcomings, there are no group listings, and ScheduleOnline is ill suited for

groups trolling for new members. The site also lacks a contact database and e-mail functionality, so it will not replace your PIM. Currently, there is no PIM or Palm synchronization, but this should be resolved the

beginning of April.

But whereas sites such as Jump! and Visto are online PIMs with group functionality, ScheduleOnline is a group management tool with few extraneous features. Groups seeking online management assistance should start by looking at this elegant and useful site.

Visto Briefcase



Earning our Editors' Choice for business calendaring, Visto Briefcase (www.visto.com) is the best stand-alone online PIM of the bunch. It has just enough group functionality to suffice in a few well-defined roles, such as enabling relationships between road warriors and back-office administration. But groups looking for online management or marketing assistance and users concerned with filling out their social calendars should definitely look elsewhere.

Visto offers a calendar, contact management, a to-do list, and e-mail, with up to 15MB of online storage. All modules feature a logical, streamlined interface, without extraneous bitmaps that can slow down performance.

Visto's calendar is simple but functional. It has the ability to create group appointments by sending e-mail to intended participants, though you can't easily view or synchronize others'

Editors' Choice

- Business Calendar: Visto Briefcase
- Social Calendar: When.com



Though brand-new, online calendaring is already segmenting into discrete submarkets that pre-

vent any one product from being the ideal, one-size-fits-all solution. That said, leaders in the individual segments are already emerging.

Road warriors seeking an online PIM will adore Visto Briefcase, whose most recent facelift has added several key features and made most basic services free. Though light in group-oriented features, Visto Briefcase wins our Editors' Choice as the best online PIM.

For those interested in expanding their social calendars, When.com broke from the gate fast, with strong online content and ever-expanding e-commerce links. Though When.com will have to pedal fast to stay ahead of Lycos' MyTime.com, it's the clear Editors' Choice in this category.

Our honorable mention is Jintek's ScheduleOnline, a must-have group organizational tool with little general applicability. Nevertheless, ScheduleOnline's streamlined interface is a model for all calendaring sites to follow.

schedules Visto conforms to the vCalendar specification, so appointments mailed to non-Visto users easily integrate into compliant PIMs such as Outlook.

In beta at the time we tested, Visto's task list was limited. You can select start and due dates and set task priority and category, but you can't create recurring tasks or send yourself e-mail reminders. We liked Visto's e-mail capabilities, though; it can import two POP3 mail accounts and is well integrated with Visto's calendar and address book. You can also upload and store 15MB of data on the Visto site.

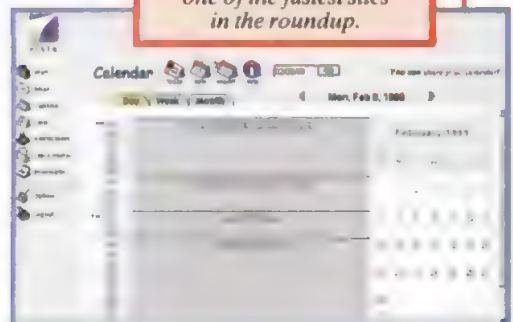
Visto has no real group capabilities, but each user is provided with a unique Web site containing a schedule and files section, which is a convenient mechanism for keeping third parties apprised of one's schedule. By design-

ating appointments as public or private, you control what's seen by visitors: Private appointments show as blocked-out areas of time.

Remote users can view the calendar and e-mail requests for meetings, but they can't edit the

Visto Briefcase
Visto Corp.,
Mountain View, CA; 650-930-5000;
www.visto.com
413 at www.pcmag.com/infolink

SPEEDY: Visto's interface is professional and mostly text-based; it was one of the fastest sites in the roundup.



FIRST LOOKS

calendar directly. They can also download files from other users' sites, with password protection available, providing cheap and easy FTP capabilities.

To synchronize your Visto account, you use Briefcase Assistant (a free downloadable application at Visto's Web site), which worked well with Outlook 98 on our tests and also works with ACT! and Lotus Organizer. Visto can't directly synchronize with Palm devices, but you can synchronize your Palm data by converting it to Outlook format with third-party tools.

All in all, Visto's appearance, functionality, and speed make it ideal for any user who can live with the site's limited group feature set.

When.com



If you don't need PIM or Palm synchronization, When.com is ideal for keeping up with the latest books, music, movies, and events about town. The site is merely adequate for workgroups, unsuitable for groups seeking additional members, and a poor choice for business users seeking on-the-road connectivity with work mates and PIM-like data.

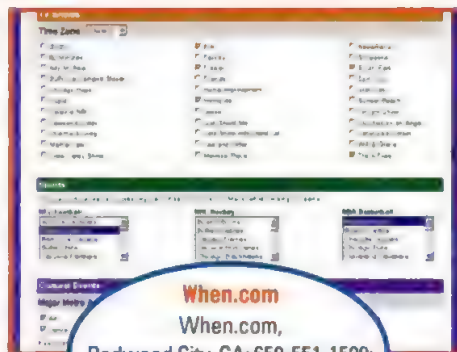
Simply stated, When.com was created to assist your schedule-oriented purchase decisions. When setting up your account, you identify favorite book genres, preferred cultural and sporting events, and TV and movie preferences. As products and events that meet your criteria are announced, they appear on your calendar, usually with e-commerce links.

A cookie-driven log-on simplifies access to the calendar, which offers daily, weekly, and monthly views. The daily view is best, giving you weather reports and horoscope on top, your

schedule on the left, and relevant books, movies, sports, and television events on the right. You can also browse a directory for events that don't automatically filter into your schedule.

Touching a button adds time-driven events such as TV shows to your schedule, or you can use simple calendar controls to create your own events. But you can't integrate your When.com schedule with PIM or Palm devices, though When.com plans to offer synchronization by the end of March.

You create a group calendar by naming the group, assigning a group log-on and password, and identifying members by e-mail address. All members are sent an e-mail with log-on information, and any member can create and mail notice of an event to any or all members. There is no group listing for potential members to scan, though, a problem for groups looking for members. Group calendars are similar



When.com
When.com,
Redwood City, CA; 650-551-1500;
www.when.com
414 at www.pcmag.com/infolink

YOUR PROFILE: During registration, When.com captures extensive preferences data that it uses to filter information onto your schedule.

to individual calendars, but you'll find little integration between the two. For example, group events don't appear on members' calendars, and there is no conflict resolution between groups' and members' schedules. Business users will also miss integrated e-mail function-

ality and to-do lists.

Though, in general, When.com is a whole lot cheaper than a social secretary, and it provides much more information. It's not for everyone, but When.com is a great site to help you figure out what to do on Saturday night.

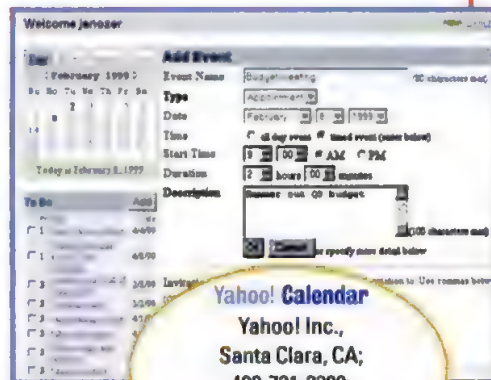
Yahoo! Calendar

Yahoo!'s trio of services—e-mail, address book, and calendar—are capable online applications, but they're poorly integrated compared with other products in this roundup. Yahoo!'s vibrant club community is a real strength, however, and the brand-new Small Business Connected Office appears promising as a small business organization tool.

Yahoo! Calendar supports scheduled events and unscheduled to-do tasks, which are maintained in a separate list. Event creation is flexible: You can create recurring events, e-mail notices to third parties, and send up to two reminders to your e-mail account, pager, or cellular phone, a useful feature. If your e-mail recipients have

Yahoo! calendars, one touch of the message schedules your event on their calendars. To-do items are a touch more perfunctory, consisting of a description, due date, priority, and status. The to-do list sits to the left of the main calendar, with a box to check once the task is completed.

Although Yahoo! offers e-mail and an address book, these have little integration with the calendar. For example, you can't use e-mail addresses from your address book when scheduling items on the calendar, a feature offered by most other sites with e-mail support.



Yahoo! Calendar

Yahoo! Inc.,
Santa Clara, CA;
408-731-3300;

<http://calendar.yahoo.com>
415 at www.pcmag.com/infolink

LESS INTEGRATION Yahoo! is the least integrated site in this roundup. Here you see that you can't access your address book when creating appointments in the calendar.

Yahoo!'s club facility is very active, and you can easily add group activities to your personal schedule. You can't see group schedules from your personal schedule, though, as you can with MyTime; this complicates the scheduling process, and club links can easily be overlooked on the Yahoo! site.

At the time of our review, Yahoo! announced the Small Business Connected Office, a service with such impressive features as a shared calendar and contact database, group e-mail, a message board, and chat functions. Unfortunately, time didn't allow a review of these new functions.

Yahoo!'s calendaring functions have some strengths, such as data synchronization with Outlook, Palm Desktop, and the REX Pro, the last a unique feature. But the sheer busyness of the Yahoo! site makes desired services hard to find, a disadvantage compared with single-function sites such as When.com and Schedule-Online, and integration lags behind that offered by other sites. (Softbank, Ziff-Davis's primary shareholder, is an investor in Yahoo!) **PC**

STATISTICA 99

Statistical Solutions

StatSoft offers the largest selection of general and specialized statistical and graphical methods in a single software package. **STATISTICA** has an unprecedented record of recognition by users and reviewers (see below). In addition to its unmatched power and comprehensiveness, it is also incredibly user-friendly - designed to meet the most basic needs as well as the most advanced.

STATISTICA provides a large library of advanced and specialized procedures, open architecture, and includes a powerful development environment (**STATISTICA BASIC**).

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More specialized tools such as **STATISTICA Neural Networks**, **STATISTICA Power Analysis**, and others also available (stand alone or companion products).

Industrial/SPC Solutions

StatSoft offers a wide selection of products for quality control and improvement applications, including:

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STATISTICA Process Analysis includes gage repeatability and reproducibility (R&R), sampling plans, and more.

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These and other QC/SPC products available in single-user or groupware (enterprise, see below) versions offer the most flexible monitoring and analytical tools for your quality control and improvement needs.

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STATISTICA Enterprise-wide System (SENS) is a groupware version of **STATISTICA** fully integrated with a powerful central data warehouse that provides an efficient general interface to enterprise-wide repositories of data and a means for collaborative work (extensive groupware functionality).

STATISTICA Enterprise-wide SPC System (SEWSS) is an integrated multi-user software package that provides complete SPC (statistical process control) functionality for enterprise installations. **SEWSS** includes a central database, provides all tools necessary to process and manage data from multiple channels, and coordinate the work of multiple operators, QC engineers and supervisors.

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Interactive WEB site:
www.statsoft.com



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Quad Xeon Servers Get L2 Boost

Enterprise-class servers from Dell and HP benefit from Intel's new 450-MHz Xeon processor with 2MB of L2 cache.

By Russ Iwanchuk and
Jeffrey G. Witt

Cache—that's of the L2 variety—is king in the world of enterprise-class servers. And no one knows that better than Intel, which is partly why the company recently introduced a new flavor of Pentium II Xeon for servers: 450 MHz with 2MB of L2 cache.

To test out this processor, we acquired new, rack-mountable, four-way servers: the Dell PowerEdge 6350 and the Hewlett-Packard NetServer LXr 8000. As shown by our ServerBench tests, the extra cache pays off to the tune of up to 30 percent more transactions per second at peak performance levels.

Dell PowerEdge 6350

In most server rooms, getting as much processing power in as little space as possible is key. Measuring in at four rack units in height, the \$42,600 (direct) Dell PowerEdge 6350 (\$45,672 with 2GB of RAM) packs a big punch in a relatively small package.

You'll have to look outside the box for the kind of storage this server is likely to drive—inside, there's only room for OS disks. ISPs or other data centers that are looking to maximize CPU density and consolidate storage—and can give up some scalability features—should consider this machine a contender.

The 6350 has a lockable front, hinged in the middle. Unlock the front and swing it aside to find the power switch, CD-ROM drive, 3.5-inch floppy disk drive, and three 1.0-inch drive bays. This provides only enough room for an OS volume; data is kept in a separate enclosure.

Most administrators will want to use two disks in a mirrored configuration for the OS or use all three disks as a RAID 5 set (an option not possible

with the HP server). We tested ours with a single 9GB disk installed with Windows NT Server 4.0 with Service Pack 4. A common option for this server should be Dell's PowerVault 650, an external storage array. We

tested a PowerVault 200S loaded with six 10,000-rpm 9GB Ultra2 LVD drives.

The 6350 uses Intel's 450NX chip set but supports up to 4GB of RAM, half the LXr 8000's whopping 8GB capacity. On the system board, the 6350 has four 64-bit hot-swap PCI slots and three 32-bit hot-swap slots; again, giving up some expandability to keep enclosure size down.

RADICAL RAID

Dell's array and RAID controller combination certainly stood out. The company's new PowerEdge RAID Controller (PERC) 2 is a 64-bit PCI card, with a 233-MHz StrongARM processor, four Ultra2 SCSI channels, and up to 128MB of cache. The PowerVault 200S has a split backplane; for our testing, the six-disk array was split over two of the PERC 2's channels.

The 6350's impressive hardware allows Dell to claim true LVD support at 80 MBps, which is the maximum data rate of Ultra2 SCSI. But

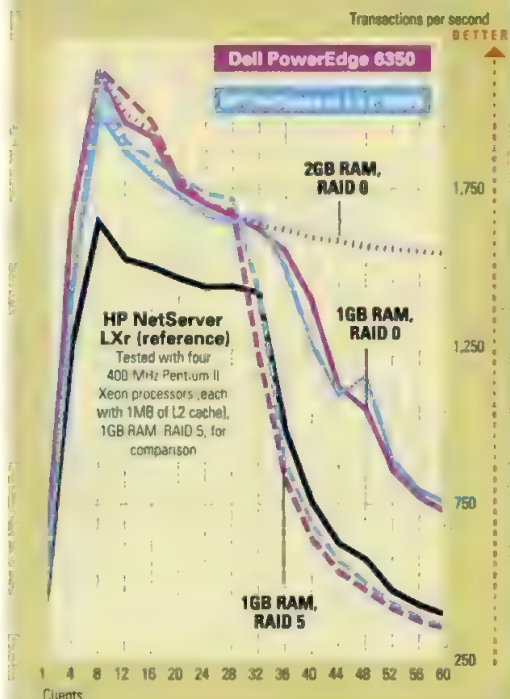
COMPACT: The Dell PowerEdge 6350 is a uniquely small four rack units in height.



SERVERBENCH TESTS

450-MHz Xeon Servers

To gauge the benefits of extra L2 cache, we reconfigured the HP NetServer LXr 8000 with four 400-MHz Pentium II Xeon processors, each with 1MB of L2 cache. Our ServerBench tests show that the extra 1MB of cache in the new Xeon/450 translates into 30 percent more transactions processed per second at peak performance levels. But as we added more and more clients, the benefits of the extra cache visibly decreased.



this setup showed virtually no advantage over the HP system on our ServerBench tests. For configuring the RAID controller, (mostly) gone are the days of fiddling around in BIOS-level utilities. The PERC 2 has a Windows NT-based GUI, from which you can perform 95 percent of RAID setup and management tasks.

AT YOUR SERVICE

Ease of service is essential for a rack-mountable system; after examining the 6350, it's apparent that Dell kept this in mind. To slide the server out of the rack, you simply loosen four thumbscrews. Near the front panel, you'll find three hot-swappable, redundant power supplies. These are simple to remove and replace: Just push down on the handle to turn off the supply, then lift up on the handle to remove the supply.

Behind the power supplies is an integrated fan unit that contains all four of the system's fans in one pull-out assembly. We prefer HP's system of independent fans, though, because you can remove just one and leave the rest cooling the system. Another issue we had was with the ribbon cables that traverse beneath the fan assembly: We found them working their way toward obstructing the fan's power connector.

Behind the fans is the system board, revealed by a locking pair of swing-out access doors. These doors are hinged on the



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Anyone Can Sell You A 500MHz Machine. Only Micron Shows You How To Use That Power To Squash Your Competition Like A Bug.

If you're looking for a system powerful enough to carry you into the next millennium, you've found it. Everything about our new Millennium 500, including Intel's latest Pentium III processor, NSTL tested Y2K compliance, a one-year subscription to Micron University, and Micron's free upgrade to Microsoft Office 2000 is designed to maximize productivity and minimize cost over years of ownership. When you choose Micron, you get more than a powerful system, you

get an entirely new set of tools designed specifically to meet your unique needs. Tools like Micron University, an incredible new online training tool, offers more than one hundred free¹ online classes, seminars and self-paced tutorials. Ask yourself how many thousands of dollars your company spends on training. Then order any new Micron system and get a free¹ year of training at Micron University. Call today or visit www.micronpc.com/pcmag.



Get Ahead.

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INSTRUCTOR-LED CLASSES.

3. Learning takes place in a virtual classroom, which utilizes a powerful, yet simple to use, threaded message board. Each class is led by industry experts and professional trainers so you know you're being taught by the best. You'll get personalized attention and do it all from the keyboard of your computer...no matter where you are!

SELF-STUDY TUTORIALS.

4. Learn on your own by following comprehensive tutorials, involving a series of learning exercises. After you master the skills and concepts of each tutorial, you can move on to the next lesson or choose a new topic. You can take tutorials to become a power user on the most popular software applications on the market including Microsoft Office and Windows NT® Workstation.

With a Pentium® III processor 500MHz and overnight delivery, this is the system of tomorrow... literally.

Why wait for the ultimate system? Order a Micron Millennia MAX 500 with the power of the new Intel Pentium III processor today and we'll deliver it to your door tomorrow*. It's that easy.

Award-Winning Micron Millennia Systems. Now available with the New Intel® Pentium III Processor 500MHz.



Model Name	Millennia C400
Processor	Intel® Celeron® processor 400MHz
Cache	128KB internal L2 cache
RAM	64MB SDRAM
Hard Drive	8.4GB Ultra ATA hard drive*
Monitor	17" Micron 700Hz monitor (15.9" display)
DVD/CD-ROM	4X max speed CD-ROM drive
Modem	3Com 1500baud V.90 WinModem**
Graphics	3MB AGP graphics 3Dfx V850 2X
Sound System	PCI 64-voice WaveTable sound
Speakers	Adams 2000W speakers
Warranty	5-year/3-year Micron Power Limited warranty
Training	1-year free* training @ Micron U online
Software Included	Microsoft® Windows® 98 Microsoft Office 97 Small Business Edition Free* Office 2000 upgrade Norton AntiVirus

Also Included: Microware™ case
104-key enhanced keyboard
Microsoft IntelliMouse™
3.5" floppy drive

Factory Direct Price **\$1,299** \$45/mo.
Business Lease
36 mos.**

Upgrade to:
19" Micron 900Lx (18" display) monitor
6X max speed DVD-ROM drive***
13GB Ultra ATA hard drive*



Model Name	Millennia MAX 400
Processor	Intel Pentium II processor 400MHz
Cache	32KB internal L2 cache
RAM	64MB 500MHz SDRAM
Hard Drive	13GB Ultra ATA hard drive*
Monitor	17" Micron 700Hz monitor (15.9" display)
DVD/CD-ROM	4X max speed CD-ROM drive
Modem	3Com 1500baud V.90 WinModem**
Graphics	3MB AGP graphics 3Dfx V850 2X
Sound System	PCI 128-voice WaveTable sound
Speakers	Adams 2000W speakers
Warranty	5-year/3-year Micron Power Limited warranty
Training	1-year free* training @ Micron U online
Software Included	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free* Office 2000 upgrade Norton AntiVirus

Also Included: Microware™ case
104-key enhanced keyboard
Microsoft IntelliMouse™
3.5" floppy drive

Factory Direct Price **\$1,599** \$55/mo.
Business Lease
36 mos.**

Upgrade to:
19" Micron 900Lx (18" display) monitor
6X max speed DVD-ROM drive***
16MB Diamond Viper 550 Tri 2X AGP graphics



Model Name	Millennia MAX 500
Processor	Intel Pentium III processor 500MHz
Cache	32KB internal L2 cache
RAM	64MB 100MHz SDRAM
Hard Drive	13GB Ultra ATA hard drive*
Monitor	17" Micron 700Hz (15.9" display) monitor
DVD/CD-ROM	4X max speed CD-ROM drive
Modem	3Com 1500baud V.90 WinModem**
Graphics	3MB Diamond Viper 550 Tri 2X AGP graphics
Sound System	PCI 128-voice WaveTable sound
Speakers	Adams 2000W speakers
Warranty	5-year/3-year Micron Power Limited warranty
Training	1-year free* training @ Micron U online
Software Included	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free* Office 2000 upgrade Norton AntiVirus

Also Included: Microware™ case
104-key enhanced keyboard
Microsoft IntelliMouse™
3.5" floppy drive

Factory Direct Price **\$1,999** \$69/mo.
Business Lease
36 mos.**

Upgrade to:
19" Micron 900Lx (18" display) monitor
6X max speed DVD-ROM drive***
128MB 100MHz SDRAM



Model Name	Millennia MAX 500
Processor	Intel Pentium III processor 500MHz
Cache	32KB internal L2 cache
RAM	128MB PC100 SDRAM
Hard Drive	13GB Ultra ATA hard drive*
Monitor	17" Micron 700Hz (15.9" display) monitor
DVD/CD-ROM	6X max speed DVD-ROM drive
Modem	3Com 1500baud V.90 WinModem**
Graphics	3MB Diamond Viper 550 Tri 2X AGP graphics
Sound System	PCI 128-voice WaveTable sound
Speakers	Adams 2000W 3-piece speaker set
Warranty	5-year/3-year Micron Power Limited warranty
Training	1-year free* training @ Micron U online
Software Included	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free* Office 2000 upgrade Norton AntiVirus

Also Included: 100MB Image Zip drive
Micron Microware case
104-key enhanced keyboard
Microsoft IntelliMouse™
3.5" floppy drive

Factory Direct Price **\$2,499** \$87/mo.
Business Lease
36 mos.**

Upgrade to:
Samsung 15" 1500Lx 1500Lx monitor
Mitsumi 3-piece flat panel speaker system
19" Micron 900Lx (18" display) monitor



Model Name	Millennia MAX 500
Processor	Intel Pentium III processor 500MHz
Cache	32KB internal L2 cache
RAM	128MB 100MHz SDRAM
Hard Drive	13GB Ultra ATA hard drive*
Monitor	19" Micron LCD flat panel display
DVD/CD-ROM	6X max speed DVD-ROM drive
Modem	3Com 1500baud V.90 WinModem**
Graphics	3MB Diamond Viper 550 Tri 2X AGP graphics
Sound System	Samsung 3-piece flat panel speaker system
Speakers	Adams 2000W 3-piece speaker set
Warranty	5-year/3-year Micron Power Limited warranty
Training	1-year free* training @ Micron U online
Software Included	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free* Office 2000 upgrade Norton AntiVirus

Also Included: 100MB Image Zip drive
Micron Microware case
104-key enhanced keyboard
Microsoft IntelliMouse™
3.5" floppy drive

Factory Direct Price **\$3,499** \$121/mo.
Business Lease
36 mos.**

Upgrade to:
15" Micron 900Lx (18" display) monitor
Sony CD/ROM***

The Critics Rave



New Rules.



New Tools.™

*Next-day delivery available only on \$2499 Millennia MAX 500MHz configuration shown above. Orders for Intel Pentium® II systems cannot be taken until February 26, 1999 10:00am. Systems will be shipped via overnight delivery for orders placed by noon MST Monday through Thursday. **Optional modem. ***Optional hard drive. ****Optional monitor.

**ORDER ONLINE WWW.MICRONPC.COM/PCMAG
OR CALL 1-888-215-6512**



HELP FOR THE MOBILE WORKAHOLIC



When using TREK² on the plane, try not to laugh when the 14.1 inch monitor dwarfs the guy's next to you. It's just not a very nice thing to do.

Pack light — there's nothing worse than a carry-on that leaves divots in your shoulder, which is why the TREK² is as thin as 1.7".

Avoid the isolation induced by the single-use, personal mini-soaps of the hotel room by staying connected with an optional 56K modem. **

INTRODUCING THE NEW FULLY- LOADED 366MHz MICRON TREK²



AMY ALCON, MD

Pediatrician
System: Micron TransPort TREK
Favorite Feature: Brilliant Display
Purpose: Online Medical Research
For The Whole Story: www.micronpc.com



BOB PARKER

Owner/Founder Parker Motor Sports
Dominant Indy Race Car Team
System: Micron TransPort TREK Notebooks/
Millennium Desktops
Favorite Feature: Speed — Of Course!
Purpose: Telemetry between Indy Car and Pit Crew
For The Whole Story: www.micronpc.com



TREK²

TREK² 366MHz
The Ultimate Desktop Replacement
\$2,699

- Intel's New Pentium® II processor 366MHz
- 64MB SDRAM
- 4GB hard drive (removable) *
- 14.1" XGA TFT display
- 24X CD-ROM (max. is 24X, min. is 17X)
- 4MB AGP graphics
- 3.5" floppy drive (dedicated bay)
- Microsoft Windows 98
- Microsoft Office 97 Small Business Edition
- Free Office 2000 Upgrade*
- 1-Year Free* Training at Micron U online



PENTIUM® II PROCESSOR POWER, AGP GRAPHICS AND A 14.1" DISPLAY AT BREAKTHROUGH PRICING



Experts and industry pundits agree that Micron makes some of the world's best notebooks. Our product lines have won the coveted *PC Magazine* Editors' Choice award along with a myriad of other prestigious awards. And the new TransPort² TREK² is no exception. *PC World* ranked the new TransPort TREK the #1 budget notebook available today*. And with a Pentium II processor 366MHz, AGP graphics, 1-year free* training at Micron U, optional DVD and a gigantic 14.1" display, the TransPort TREK² is one of the best desktop replacements you can buy. Call Micron today and get a TransPort TREK² custom configured to your specific needs direct from the factory at unbelievably low prices.

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In our continuing effort to build not only powerful systems, but powerful users, we are proud to introduce Micron University. Offering over one hundred free* online classes, seminars and self-paced tutorials on the hottest topics in computing and business today, Micron University will turn any Micron owner into a highly educated power-user. When you combine this powerful new tool with Micron's revolutionary MPower™ purchase program, offering qualified users no interest,** no payments for six months and our PowerXchange trade-in options, you get more than a great machine at a great price, you get a deal you probably won't find anywhere else. Call or visit our Web site today to order your system and to find out more about Micron University at www.micronu.com.

"The TransPort TREK²
is the Finest Budget
Notebook We've Run
Through Our Mill."
—*PC World*, Ranked #1,
"Best Buy," April '98

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A non-refundable up-front freight charge applies for participation in PowerXchange to cover cost of return packaging and processing.

Clients Don't Come To You

3

VOL. 11 NO. 08
99.1

Work hard, but leave time for some major goofing off. And with an optional DVD-ROM drive and 1.5" floppy included, whether it's games, movies or work, you'll have access to it all.

Don't be afraid to hug your notebook. Sometimes, nothing is more comforting to the weary road warrior than 366MHz of mobile desktop-replacing power.

The world is a book,
and those who do not
travel, read only a page.
—William Goins, III



TREK² 266



TREK² 300



New!
TREK² 333



New!
TREK² 366

Model Name	TREK² 266	TREK² 300	TREK² 333	TREK² 366
Processor	Intel® Pentium® II processor 266MHz	Intel Pentium II processor 300MHz	Intel Pentium II processor 333MHz	Intel Pentium II processor 366MHz
Cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache	256KB L2 on die cache	256KB L2 on die cache
RAM	32MB EDO DRAM	32MB SDRAM	64MB SDRAM	64MB SDRAM
Hard Drive	4GB hard drive (removable)*	4GB hard drive (removable)*	4GB hard drive (removable)*	4GB hard drive (removable)*
Monitor	12.1" SVGA TFT display	13.3" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display
Extra Storage	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)
CD-ROM	24X CD-ROM (max. is 24X, min. is 17X)	24X CD-ROM (max. is 24X, min. is 17X)	24X CD-ROM (max. is 24X, min. is 17X)	24X CD-ROM (max. is 24X, min. is 17X)
Graphics	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator
Sound System	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone
Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Software Included	Microsoft® Windows® 98 System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition Free* Upgrade to Microsoft Office 2000 System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition Free* Upgrade to Microsoft Office 2000 System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition Free* Upgrade to Microsoft Office 2000 System Wizard Mobile Client™ Norton AntiVirus
Training:	1-year free* training @ Micron U online	1-year free* training @ Micron U online	1-year free* training @ Micron U online	1-year free* training @ Micron U online
Also Includes:	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports
Factory Direct Price	\$1,699 \$59/mo.	\$1,999 \$69/mo.	\$2,499 \$87/mo.	\$2,699 \$94/mo.
Order Code:	20022 Business Lease 36 mos. ^{1,2}	20023 Business Lease 36 mos. ^{1,2}	20020 Business Lease 36 mos. ^{1,2}	20021 Business Lease 36 mos. ^{1,2}

New Rules. New Tools.™



Micron™ notebooks are among the very best available. Our notebooks have been critically acclaimed by industry pundits and power users alike. And the TransPort TREK² is no exception. Call Micron today and order any of our award-winning notebooks custom configured to meet your specific needs.



ORDER ONLINE WWW.MICRONPC.COM/PCMAG
OR CALL 1-888-215-6512



PUT THE POWER OF WINDOWS NT[®] TECHNOLOGY TO WORK FOR YOU.

OPTIMIZED FOR WINDOWS NT

1. As the first direct PC manufacturer to ship Windows NT back in '94, Micron's knowledge and experience can help you maximize your Windows NT network, now and into the future.

HIGH-PERFORMANCE, RELIABLE NETWORKING

2. The Micron ClientPro desktop and NetFRAME server utilize industry-standard technology and are powered by Intel's latest chip set technology, including the Intel Pentium II and Pentium II Xeon[™] processors.

PREPARE FOR THE FUTURE NOW WITH MICROSOFT[®] WINDOWS[®] 2000-READY SYSTEMS

As the industry looks ahead to Microsoft Windows 2000 (built on NT technology), Micron offers a way to get ahead of the game today. Whether you're looking to upgrade to Windows NT[®] 4.0 or preparing for a company-wide shift to Windows 2000, our ClientPro[®] managed PCs and Micron[™] NetFRAME[®] servers will be among the first to support the full potential of Microsoft Windows 2000. Network-ready right out of the box, built on industry standards, and packing the power of the Intel[®] Pentium[®] III processor 500MHz, the ClientPro puts more manageable power in your office. And if you're looking for a reliable and expandable server, it would be tough to beat Micron's NetFRAME servers running with the powerful new Intel Pentium II Xeon[™] processor. Nothing maximizes a network today and tomorrow like Windows NT technology – and no one delivers it better than Micron. And as the first PC company to ship Microsoft Windows NT in 1994, it's no surprise that Micron users get early access to Windows 2000 through Micron's **AdvanceDeploy** program.

**"MICRON'S NETFRAME 3100 GIVES
YOUR WEB CUSTOMERS WHAT THEY
WANT BEFORE THEY CLICK AWAY."**

— PC Computing, A-List, Best Web Server, Nov. '98

**"MICRON'S DUAL-PROCESSOR...
SERVER RUNS FULL SPEED AHEAD."**

— PC Computing, A-List, Editors' Choice

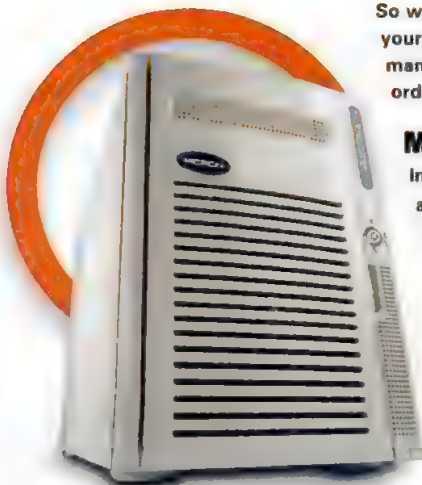


So when you're ready to put the power of the ultimate business operating system into your office network, look to the experience and affordability of Micron ClientPro managed PCs and Micron NetFRAME servers. Call today for more information or to order direct from the factory or visit www.micronpc.com/pcomag.

Micron University – The Ultimate Training Tool

In our continuing effort to build not only powerful systems, but powerful users, we are proud to introduce Micron University. Offering over one hundred free¹ online classes, seminars and self-paced tutorials on the hottest topics in computing and business today, Micron University will turn any Micron owner into a highly trained power-user. When you combine this powerful new tool with Micron's revolutionary MPower[™] purchase program, offering qualified users no interest,² no payments for six months and our PowerXchange trade-in options, you get more than a great machine at a great price, you get a deal you probably won't find anywhere else. Call today to order your system and to find out more about Micron University.

Micron NetFRAME 6200



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PLANNED TECHNOLOGY MIGRATION

3. To simplify technology planning and implementation, Micron designs all ClientPro and NetFRAME systems to have long model lifecycles, consistent components and planned technology transitions including the upcoming industry shift to Microsoft Windows 2000.

HIGHLY MANAGED

4. Based on the Wired for Management specification and Desktop Management Interface compliant, ClientPro can be managed from a single point on the network. And every ClientPro desktop and NetFRAME server is backed by Micron's unmatched service and support programs.

3

WOL ON SEC 99.3

New Rules. New Tools.

Introducing the new ClientPro CS 500 with Intel's New Pentium III processor 500MHz.



NEW!
ClientPro CS 500
The Highest Performing Managed PC*

Intel® Pentium® III processor 500MHz
528MB Internal L2 cache
128MB 100MHz SDRAM
34.4GB Ultra ATA hard drive*
17" Micro 700Hz (15.9" display)
40X max speed CD-ROM drive
64K Real 3D Starfighter AGP graphics
56-voice PCI Modem/call control
32MB 3COM VxL 10/100 network card
5-year/3-year Micron Power® limited warranty
1-year free* training of Micron IT online

Intel LANdesk® Client Manager
Microsoft® Windows NT® Workstation 4.0
Remote Antivirus

SMART II hard drive monitoring
Chassis intrusion detection
Fan, temperature, and voltage problem reporting
Virus detection reporting
Remote Wake Up capability
Hot/Power case
3.5" floppy drive
104-key enhanced keyboard
Microsoft® IntelliMouse®



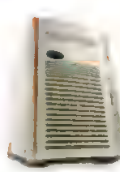
NetFRAME 3101
The Top-Rated Web Server* PC Computing Nov. 99

Intel Pentium III processor 450MHz
512MB Internal L2 cache
128MB ECC 100MHz SDRAM
9GB UDMA LBA 1" hard drive*
33X max speed CD-ROM drive
5-year/3-year Micron Power limited warranty
Dedicated server technical support, 7x24
1-year next-business-day on-site service**

Intel LANdesk Server Manager
Emergency Management Port Console

Supports up to two Intel Pentium III processors
300MHz frontside bus and up to 1GB memory support
Integrated Ultra Wide SCSI-3 dual channel controller
Intel P80/100 Server Adapter
Integrated RAID upgrade support
5 expansion slots: 3 PCI, 1 ISA, 1 shared PCI/ISA
8 drive bays: 1 internal 3.5", 2 external 3.5"
1 hot-swap redundant 3.5" hard drive bays

Intel LANdesk Server Manager 6.0
Emergency Management Port Console
Microsoft Windows NT Server 4.0 (30-user license)



NetFRAME 6200
High-Powered Server For Fast Growing Businesses

Intel Pentium III Xeon® processor 450MHz
512MB Integrated L2 cache
128MB ECC 100MHz SDRAM
9GB UDMA LBA 1" hard drive*
33X max speed CD-ROM drive
5-year/3-year Micron Power limited warranty
Dedicated server technical support, 7x24
1-year next-business-day on-site service**
NBS support (3 first-year incident resolutions)

Intel LANdesk Server Manager 6.0
Emergency Management Port Console
Microsoft Windows NT Server 4.0 (30-user license)

Supports up to four Intel Pentium Xeon processors
Options for SL2X8, 1MB or 2MB L2 cache
4GB ECC ESD support (16 60MHz sockets)
Integrated Ultra-2 Wide UDMA dual channel 6
server SCSI controller
7 expansion slots: 6 PCI, 1 shared ISA/PCI
6 internal, hot-swappable hard drive bays
1 hot-swappable 400-watt power supply
(upgradable to 3 w/redundancy)
3 internal 5.25" media bays and floppy drive
Free-standing pedestal chassis standard
(To rack mount option available)



NetFRAME 9200
The Mission-Critical Enterprise Server

Intel Pentium III Xeon processor 450MHz
512MB Integrated L2 cache
128MB ECC 100MHz SDRAM
9GB UDMA LBA 1" hard drive*
33X max speed CD-ROM drive
5-year/3-year Micron Power limited warranty
Dedicated server technical support, 7x24
1-year next-business-day on-site service**
NBS support (3 first-year incident resolutions)

Intel LANdesk Server Manager 6.0
Emergency Management Port Console
Microsoft Windows NT Server 4.0 (30-user license)

Supports up to four Intel Pentium Xeon processors
Options for SL2X8, 1MB or 2MB L2 cache
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Intel P80/100 Server Adapter w/Adaptive Load
Balancing and Adaptive Fault Tolerance software
Integrated Ultra-2 Wide UDMA dual channel controller
10 expansion slots: 4 hot-plug ready 64-bit PCI slots,
two 32-bit PCI & 1 PCI/ISA dual channel
2 hot-swappable 750-watt 220-volt power supplies
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(cabinet and accessories sold separately)



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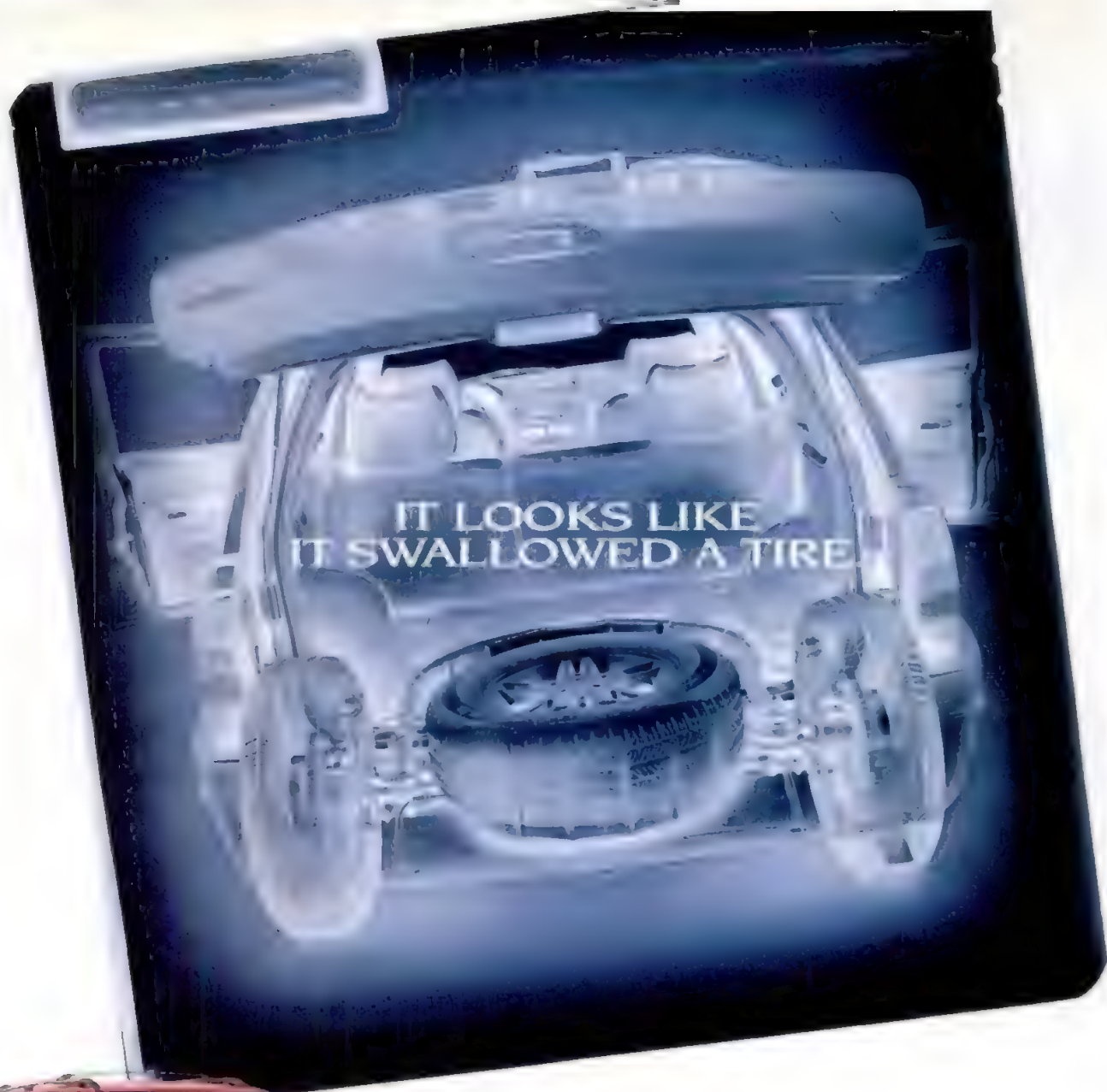
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FIRST LOOKS

edges, so they don't obstruct access in any way. We preferred this design over the LXr 8000's clunkier sheet-metal lid.

But serviceability also fell short with the PCI card-retaining clips. These are supposed to rotate away to unlock a board, then rotate back to lock it down; the idea being that no screwdriver is required to add or remove cards. We found that once released, the clips either broke or refused to lock back down. We have seen the clips work well on other Dell servers, however.

TOOLS TO MANAGE

Dell provides HP OpenView Network Node Manager Special Edition (NNM SE) and HP OpenView ManageX SE as part of its OpenManage solution. NNM SE lets you monitor and manage your network devices using SNMP and DMI, as well as manage your Dell equipment. Dell provides agents that send instrumentation-generated information to a central console.

With ManageX SE, administrators can define policies and send alerts based on Windows NT- and Dell-hardware-specific parameters. The 6350 also has an optional remote management card, the Dell Remote Assistant Card (DRAC) 2. The DRAC 2 enables administrators to control a server remotely, allowing full console redirection and letting a hung server reboot from a remote console.

For installations that demand

\$51,740 (street) NetServer LXr 8000 (\$55,610 with 2GB RAM) hits the buying checklist on all counts. This unit provides high availability, great serviceability, strong performance, and scalability with an added twist.

Hewlett-Packard is the first vendor to furnish us with a server that exploits the additional potential of the Xeon 450NX chip set. The LXr 8000 currently supports 8GB of memory (doubling other vendors' offerings) and is uniquely upgradable beyond the four-processor version, allowing eight processors. With excellent local and remote Web-based management and a multitude of service options, the system is hard to beat.

MAXIMIZE UPTIME

To ensure optimal uptime, the LXr 8000 offers ECC memory, as well as redundant and hot-swappable mass storage, fans, and power supplies. The HP 10/100TX EtherExpress Ethernet adapters provide fail-over features, and the system's four 64-bit PCI slots accommodate

The LXr 8000's 7U-high cabinet doesn't provide the same degree of rack density as the 6350, but you can still fit up to six in a rack. Unlike the small Dell unit, the LXr 8000r leaves room for additional RAM and CPUs and bests the 6350 in slot density. The LXr 8000 features

four 64-bit and six 32-bit PCI slots, which includes one shared ISA slot, versus the four 64-bit and three 32-bit PCI slots found inside the Dell box.

Connecting the disk subsystem is HP's NetRAID adapter 3SI, which has three internal and three external channels. Whereas the controller has

cessible simply by twisting the thumbscrews on a protective cover. Expansion slots have indicator lights to inform you if they're in use, and the hot-swap PCI slots are divided by plastic guides to block unwanted touching of adapters.

ONE-STOP MANAGEABILITY

On the management front, Hewlett-Packard leaves no stone unturned, taking a two-pronged approach with its TopTools for Servers and OpenView ManageX/SE. TopTools lets you monitor, configure, generate alerts, and troubleshoot server conditions—all through a Web browser—both locally and remotely. You can monitor subsystem features and functions, including drive capacity and network adapter activity, as well as browse SNMP, DMI, and

WBEM (Web-Based Enterprise Management) information.

Alerts are configured to inform you of performance interruptions and impending failures; they can also be directed to larger-scale management platforms such as OpenView. Extending TopTools' reach is HP's TopTools Remote Control Card (bundled with each system), which lets you access the server via LAN or dial-up, even when it's down. The card provides rebooting capabilities, remote system control, and access to all TopTools' management features. Open-



AVAILABLE: Pull the HP unit forward and you can access components from the top.

only 16MB of cache on board (compared with Dell's 128MB), it performed identically

to the 6350 on our tests at both RAID 0 and 5 configurations. To configure the SCSI adapter, HP includes its NetRAID Assistant, an easy-to-use GUI that makes reconfiguring, monitoring, or rebuilding the array, as well as building hot spares, effortless.

"...LOOKS AND
PERFORMS AS
IF IT'S MADE
OF STEEL."

Mobile Computing &
Communications
November 1998



THE SUV OF NOTEBOOKS.

Mobile Computing & Communications calls it "tough enough for the road" and "reliable." PC/Computing says "Not many notebooks pack both grit and polish. But this is a rare bird." The industry awards for the NEC Versa® notebooks could describe a 4-wheel-drive. Each features the industry's leading display technology: NEC's XGA TFT panoramic color screen just 1/4" thick. Whether it's the 4.8 lb. road-warrior Versa SX, or the corporate desktop-replacement Versa LX, both include NEC's VersaBay™ design that allows swapping of 6 cross-compatible storage and power devices. (Users like the versatility; IS will like tracking fewer accessories.) Built with high-performance Intel® mobile Pentium® II processors, the Versa LX and SX dock universally, are built to order and include a 3-year limited warranty. Bottom line, they're a smart IS investment you can rely on to perform — on the road and off.

The NEC Versa SX notebook features the new Intel® mobile Pentium® II processors 366MHz and 333MHz. The NEC Versa LX notebook will soon include the newest Intel mobile Pentium II processors. Both notebooks feature 14.1" XGA TFT displays, 64MB of RAM expandable to 256MB SDRAM SODIMM, and choice of Versa Dock or Versa PortBar™ docking solutions. Also ask about the Versa Note system starting at just \$1699.

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January 1999



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CompuServe Meets AOL

CompuServe's latest incarnation adopts AOL's ease of use while keeping its community happy.

By Kathy Yakal

As Web portals do their darndest to emulate proprietary online services, online services return the compliment by taking on Web characteristics. CompuServe 2000 continues the Web integration begun in Version 4.0 and takes on several attributes of its sister service, AOL. CompuServe 2000's look is cleaner, simpler, and—largely—more customizable.

WEB SAVVY: Wherever you go, there you are: CompuServe 2000's on the Web.

rumors dealing with such disparate topics as soap operas, religion, and the stock market.

CompuServe 2000's new tool-

CompuServe GO words in the address window and use the History list and Back/Forward buttons to navigate. All information now displays in the embedded browser (Internet Explorer 4.01).

CompuServe's Preferences dialog box has been replaced with AOL's icon-based one, with less

control over some elements such as fonts and mail, and new additions such as "marketing preferences" (how you feel about solicitors contacting you).

Communicating with people and groups is more automated in CompuServe 2000. You can customize the

Scheduler, instructing it when to send and receive e-mail and newsgroup postings. Instant messaging is also new.

For better or worse, CompuServe 2000 uses practically an exact duplicate of AOL's e-mail system. The differences are large-

ly cosmetic, though you can't mark a message as being urgent nor can you suppress a recipient list. And you must manually enter e-mail addresses when you're creating groups rather than select them from a list.

New e-mail features include a spell-checker and the ability to have up to five member names per account. You can also have your mail forwarded to you from your old CompuServe address.

CompuServe 2000 succeeds at taking on some of AOL's attributes while maintaining CompuServe's differences. And it does this entirely within a Web browser without suffering noticeable performance problems. Bravo! **CompuServe 2000.** Price: For 5 hours per month, \$9.95, each additional hour, \$2.95; unlimited monthly usage, \$19.95. Requires: 16MB RAM, 30MB hard disk space, Microsoft Windows 95 or 98. CompuServe Interactive Services Inc., Columbus, OH; 800-848-8199, 614-457-8600; www.compuserve.com; 409 at www.pcmag.com/infolink.

What hasn't changed is

CompuServe's blend of news and information, business and personal forums, and research and communication tools. It's arguably more sedate and businesslike than AOL. But CompuServe offers something for almost everyone, including fo-

bar uses bigger, sleeker icons and provides access to e-mail, system features, people, and Web resources. The service is not as customizable as its predecessor; you can only add and delete Favorite Places.

You can enter either URLs or

Global Phoning

The Motorola Satellite Series 9500 Portable Telephone provides two-way satellite communications.

By Bruce Brown

The Motorola Satellite Series 9500 Portable Telephone (\$3,400 street average, varies per provider), which uses the Iridium satellite system, provides a way of staying in touch at all times, in any location that has a clear view of the sky. This is a great tool for when convention landline and cellular telephone networks don't work but communication is essential. Motorola also offer the receive-only Satellite Series 9501 pager with global roaming (\$500 street, not tested), which makes a good companion device.

The Iridium satellite system provides global coverage but is expensive to use. Currently, there are more than 300 service providers worldwide; PageNet

and Sprint are the largest in the U.S., along with Motorola's MCSI Business Unit. The per-minute charges for outgoing calls range from \$2 to \$3 for calls within the U.S. through \$7 to \$8 for calls in other countries and from ocean-going vessels. Incoming calls are billed to the caller.

The 9500 comes with an AC charger and an international plug kit for charging the included lithium ion battery (rated at 2 hours talk time and 16 hours standby time), a 12-volt auto-

mobile connection kit, a leather holster, and a wrist strap. Weighing a hefty pound with a battery but without a conventional cellular service cassette, the 9500 measures 2.7 by 2.4 by 7.6 inches (HWD) with the wand-style antenna in the closed position. When you extend the bulky 8.5-inch antenna, the whole unit is quite a bit larger

WORLDWIDE PORTABILITY: You can use the Motorola Satellite Telephone anywhere on the planet.

than most phones.

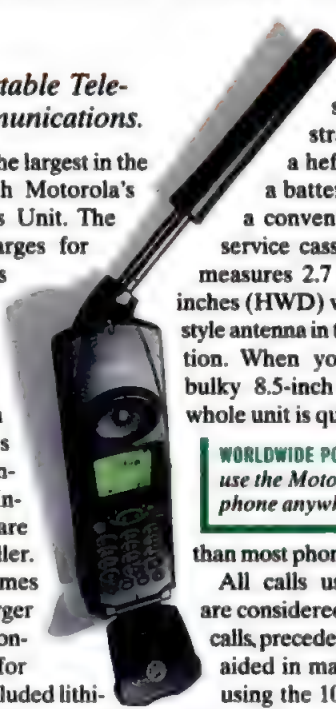
All calls using the 9500 are considered international calls, preceded by 00. You're aided in making calls and using the 100-name internal telephone directory by a bright four-line, 16-character, illuminated display and clear-

ly marked buttons.

When we tested the phone in Manhattan from the top of an office building, call quality was similar to most digital phone connections—very clear sound with an occasional delay.

A raft of accessories is available for the 9500. Options include desktop and solar chargers; extra batteries; and auxiliary, mobile, and mast antennas. An RS-232 adapter for data connection to a computer will be available later in the year.

If you want and can afford a single phone that can work anywhere in the world, the Motorola Satellite Series 9500 Portable Telephone bears investigation. **Motorola Satellite Series 9500 Portable Telephone.** Street price: \$3,400 average (varies per provider). Motorola Inc., Libertyville, IL; 888-839-4647; www.iridium.com; 408 at www.pcmag.com/infolink.





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The new ViewSonic VG180, 18.1" viewable LCD ViewPanel[®] is a case in point. It features a 160° viewing angle, a spectacular true resolution of 1,280 x 1,024, a rock solid image and amazing performance. By putting ViewSonic's VG180 ViewPanel on top of your priority list, you'll ensure your Visual Computing[™] experience is excellent.

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ViewSonic SP8150
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Windows CE H/PCs Go Pro

The new NEC MobilePro 770 and 800 feature faster CPUs and more memory.

By Bruce Brown

With the new NEC MobilePro 770 and 800, NEC Computer Systems makes up for its late arrival to the Windows CE H/PC Pro party. These two new H/PC Pros feature faster CPUs and more memory

and preferred applications. NEC is targeting the larger 800 at enterprise applications because of its 9.4-inch (diagonal) screen for document viewing.

The more portable 770, with a 8.1-inch (diagonal) screen, is intended for use in professional and business applications where its role as an extension to the PC can be maximized by its smaller weight and bulk.

The 770 weighs 1.7 pounds with battery and measures 1.1 by 9.6 by 5.2 inches (HWD), significantly thinner and less deep than the 750C model it essentially replaces, which measured 1.4 by 9.6 by 5.4 inches (HWD). The 2.6-pound

boards and is an improvement over the previous MobilePro 750C keyboard's layout, which had the right shift key placed too far to the left.

Both models also have one CompactFlash Type II slot, one PC Card Type II slot, and rechargeable lithium ion batteries, rated for 10 hours of life with the 770 and 8-plus hours in the 800. Recharging the internal batteries takes 3 to 4 hours with the power on or off.

Each H/PC Pro includes voice recording with an internal microphone, speaker, and headphone jack. You can't start and

stop recording with the case cover closed as you could with the earlier model, however.

Other features common to both models include a VGA port for PowerPoint presentations, a serial port, an infrared port, and a touch-sensitive screen for pointing, selection, drawing, and writing. Neither model features a parallel port, but an optional converter cable (\$90 street) that fits in each unit's serial port can be used with parallel printers.

The 800 has some features not found on the 770, including a single USB port and a Ken-

Windows CE Users:

If your company uses Lotus Notes for handling e-mail, calendars, and address books, CommonTime's Cadenza Concerto (\$98 direct) lets users replicate Notes PCs with Windows CE hand-held and palm-size PCs. After a simple download and installation, you can use a PDA for catching up on your e-mail and maintaining PIM data.

Concerto is one of three levels of the Cadenza Notes Client software, each with different connections and functionality. Cadenza Solo (\$49 direct) is a single-user product that enables e-mail and PIM replication with a Notes desktop system. Cadenza Concerto, the version we tested, adds the ability to connect directly to and replicate from Domino servers and supports group meeting scheduling. Cadenza Forte (\$4,000 for server, \$198 per user) lets you run Notes applications on Windows CE devices. Cadenza Solo and Concerto are both available for a 30-day free trial from the company's Web site (www.commonitime.com).

After downloading the H/PC or palm-size PC version of Cadenza Concerto, you install the software on a notebook or desktop PC running Notes 4.5 or later and Windows CE 2.0 or later. The program also supports the latest Windows CE H/PC Pro platform. Once an authorization key is e-mailed to you (after you register online), you paste or type it into the Cadenza Control database on the Notes Workspace.

Cutting and pasting the key using Microsoft Word didn't work in testing, but once we typed it in, the program installed, configured, and ran as documented during testing with a Philips Nino palm-size PC and NEC MobilePro 750C. Once the program is authorized, the Windows CE software is installed via the desktop or notebook PC.

On the Windows CE device you can configure which elements to replicate—including e-mail, contacts, calendar entries, and tasks. Cadenza includes an impressive number of preference settings for choosing which, how many, and how much of the entries to select. You can also configure the

CONNECTED: Get online with the MobilePro 770's 56K modem or pop in a PC Card to store applications or files.

than those we saw in our review of December 1, 1998, "Windows CE, Round 3." As the first Windows CE device to ship with a 64K color 800-by-600 SVGA display, the MobilePro 800 (\$1,000 street) is a terrific choice for work with full-size documents and images.

The MobilePro 770 (\$800 street) may be more compact, with less screen room and only 640-by-240 half-VGA resolution, but it has the same CPU, memory, and extremely usable keyboard as the 800. The 770 is a better choice for absolute portability and for working with applications that don't require as much on the screen.

770 VS. 800

Although each shares many attributes and features—such as a 56K internal modem and bright, attractive touch screens—the two NECs differ most noticeably in display size and resolution and also in their relative portability



800 measures 1.1 by 9.6 by 7.5 inches (HWD).

The 770 and 800 are both powered by 133-MHz NEC VR4121 MIPS 32-bit RISC CPUs and come standard with 24MB of replaceable ROM and 32MB of RAM—the maximum supported by Windows CE 3.0. There's no internal memory expansion, but you can use CompactFlash and PC Card memory cards for application and file storage. NEC sells a 16MB CompactFlash memory card (\$100 street).

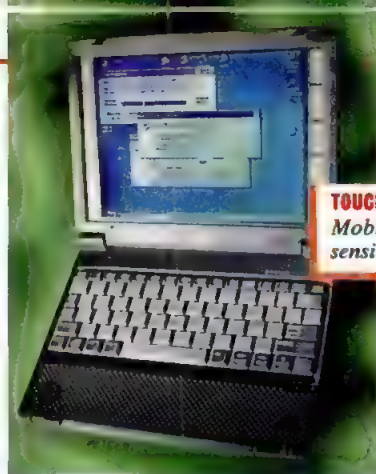
GETTING TO WORK

Both new MobilePro models have generous and responsive 78-key, 17.5-mm key pitch key-

sington security system slot for third-party locking cables. The 800's screen also features ten touch-sensitive application function keys, five of which can be easily programmed to launch system utilities, applications, or documents. The keyboards on both models have ten quick-launch application keys.

POCKET-SIZE SOFTWARE

Like other H/PC Pros, the NEC units include Microsoft Windows CE, Handheld PC Edition Version 3.0 operating system with CE Services Version 2.11. Other applications standard to



TOUCH IT: The screen of the NEC MobilePro 800 features ten touch-sensitive application function keys.

the platform include pocket versions of Access, Excel, Internet Explorer, Outlook, PowerPoint, and Solitaire, plus Word and Microsoft's new InkWriter application, all of which are loaded in system ROM. To install new ap-

plications and to synchronize and exchange files with a Windows desktop or notebook PC, the Windows CE Desktop component must be installed and the systems connect-

ed via included serial cable. A supplementary CD includes Westtek's Jetcet PowerPoint Companion for presentation creation and editing, Jetcet Print printer drivers, Ruckun's Connect Force Internet



connection wizard, Bsquare's bFax Express, PhatWare H/PC dbExplorer database manager, Puma's Intelli-

Sync for Act & Organizer, and 30-day trial versions of Sierra Imaging's Image Expert CE digital photo gallery application and Randsoft's Harmony '98 PIM synchronization software.

NEC backs the MobilePro line with a one-year warranty, including 24-hour toll-free technical support and 72-hour door-to-door repair service. An Ultra Care service upgrade contract extends the warranty coverage to three years for \$85.

Neither NEC MobilePro unit has the power to replace a conventional notebook computer—nor is that intended. But for instant-on lightweight computing with workday-long battery life, however, both models are convenient alternatives for storing and working with personal data and documents and for accessing remote data sources and e-mail.

Thinner, lighter, and \$200 less expensive than the full-screen model, the NEC MobilePro 770 is more portable and easier on the wallet, with no sacrifice to processing power, memory, or applications. If you'll be using the unit for document editing, direct PowerPoint presentations without an external monitor, or for managing digital photographs, the larger screen size and greater resolution of the NEC MobilePro 800 make it the preferred choice.

NEC MobilePro 770. Street price: \$800. **NEC MobilePro 800.** Street price: \$1,000. Requires: 8MB RAM (Windows 95), 12MB RAM (Windows NT), or 16MB RAM (Windows 98); 10MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. NEC Computer Systems; Mountain View, CA; 888-632-8707; www.nec-computers.com; 406 at www.pcmag.com/infolink.

Take (Lotus) Notes

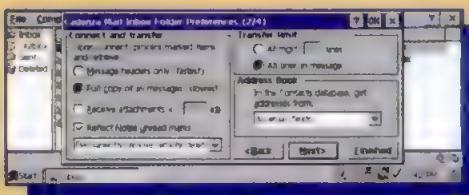
results of remote actions; determining, for example, whether events or e-mail deleted on the CE device will be ignored or permanently deleted on the desktop system.

You can install the software for both the H/PC and palm-size PC devices on the same host PC, which enables you to keep e-mail and PIM data updated on both types of PDAs as well as on your regular Notes system. But even if you don't use Notes contact and scheduling applications, you can still use the standard Windows CE PIM applications.

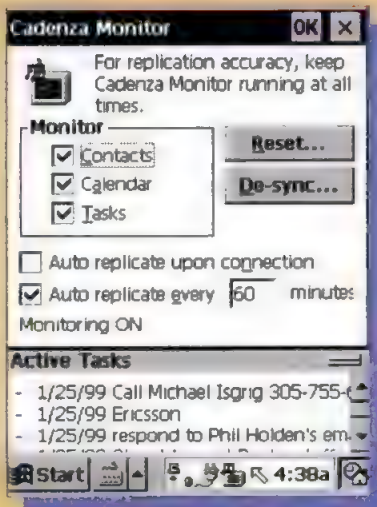
To replicate with the Notes desktop or notebook system, you don't need to be running Notes, but you must open the Mobile Devices window (with the currently connected device selected) and run the Cadenza software on the host system. To start replication on the CE device, you start the Windows CE Inbox program and simply run the Connect command—assuming you're connected with a Notes host system. You can decide to replicate all e-mail or, as we did on our test systems, just bring in new mail from the Notes Inbox for reading or filing, or you can select some other action. You can choose to replicate subject headers only or full messages (with the option to specify line lengths) with or without attachments.

A time saver for unconnected Notes users, Cadenza Concerto has sufficient power to boost Windows CE devices from passive companions to more active productivity machines.—B.B.

Cadenza Concerto. Direct price: \$98. Requires: Host PC capable of running Windows 95, 98, or NT; 8MB RAM; 5MB hard disk space; Microsoft Windows 95, 98, or NT 4.0; Lotus Notes 4.5 or later; Windows CE H/PC or palm-size PC running Windows CE 2.0 or later. CommonTime Ltd., Derby, U.K.; (44) 114 285 4250; www.commontime.com; 407 at www.pcmag.com/infolink.



ON H/PC: When you use CommonTime's Cadenza Concerto on a Windows CE H/PC, you can set preferences for selectively copying e-mail.



OR PALM PC: On a Windows CE palm-size PC, you can read and edit Notes e-mail and synchronize contacts and appointments.



SONY

The VAIO Slimtop™ LCD Computer. Power and beauty in equal measure.

It's your typical full-on, full-strength powerhouse of a PC—in a beautifully atypical package. The all-in-one package of a slim CPU, sleek LCD display and VAIO Smart™ convertible keyboard were crafted with the eye of an artist—to make even the most savvy computer user swoon.

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Things like an Ergo-Angle™ LCD Display, AutoAlert™ e-mail notification system and a Sony Memory Stick™ slot (see right for more details).

The VAIO Slimtop LCD Computer.

It could only be from Sony.

The VAIO Slimtop LCD Computer

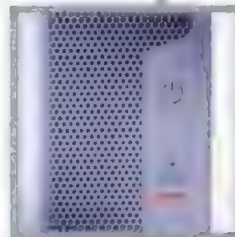
- Ergo-Angle Multimedia LCD Display (14.1" VIS)
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VAIO Smart™ Convertible Keyboard

Six programmable power keys that let you launch any application with the push of a button. A palm rest that converts to a keyboard cover for a sleek "at rest" look. And a dual-sided mouse connection for left- or right-handed use.



Sony Memory Stick™ Slot

It's smaller than a stick of gum, but it lets you easily deliver information from one electronic device to another. So you can transfer images, sounds, data and text between cameras, computers and more.

Official
launch date:
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Ace Reporter

With new features, Seagate's Crystal Reports Version 7 remains at the peak of its category.

By Stephen W. Plain

Long ago, Seagate Crystal Reports (\$395 list), from Seagate Software, earned its stripes as a top-notch solution for ad hoc reporting and software development. Version 7 features a long list of enhancements that extend its flexibility, accessibility, and power.

A significant new feature is geographic mapping. Map Expert helps you insert and link maps into your reports. During testing, we were able to insert maps into existing reports easily and quickly.

Another major addition to Crystal Reports is the Java-based Crystal Query, which lets anyone with a Web browser perform ad hoc analysis. Crystal Query uses a triple-paned dialog with database-table, query, and

results sections. Drag-and-drop query design and the ability to switch quickly between design and preview modes make this tool very approachable and powerful.

Crystal Reports offers comprehensive native and ODBC database connectivity that is almost guaranteed to work with your data source. This version adds support for ACT! 4.0, OLE DB support, and ODBC access to Oracle 8.x databases. The program is also keeping up with the popular development environments, with a new JavaBean and VCL component to support Java and Delphi development.

Another new feature is On-Demand Subreports, which lets you define several subreports within the primary report but

avoid processing them unless you select their icons. Also, you can now highlight currency and number fields based on custom criteria.

Document Import Tool, also new, gives Crystal Reports the ability to input ASCII reports from legacy databases and reverse-engineer them into Crystal reports. Once the tool analyzes the text, you can generate a report and remap the data fields. Although this enterprise tool

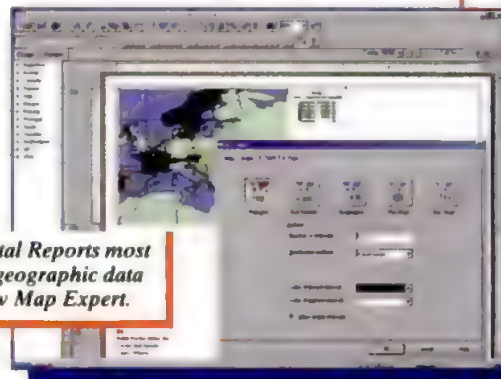
MAP IT: One of Crystal Reports most visible additions is geographic data mapping via the new Map Expert.

takes a little time to warm up to, its color-coded interface makes the process as painless as possible.

Today's PC-based reporting tools must address not only data-source compatibility but also development platforms and

end-user environments. Crystal Reports continues to evolve and remains the king of the hill in this category.

Seagate Crystal Reports Version 7. List price: \$395. Requires: For 16-bit version, 16MB RAM, 108MB hard disk space, Windows 3.1 or later. For 32-bit version, 16MB



Big Screen, Small Footprint

The Compaq TFT8000 LCD desktop monitor gives you a huge, gorgeous view—at a price to match.

By Alfred Poor

Sit down to work with a new 18.1-inch diagonal Compaq TFT8000 LCD desktop monitor (\$3,200 street) and you may feel as if you're staring at a billboard instead of a PC screen. It fills your view without taking over your desktop, but the TFT8000 may eat up your budget.

The active-matrix LCD panel uses in-plane switching—the liquid crystal cells are at right angles to traditional designs—to improve off-axis image quality. Compaq claims you have a 80-degree off-axis view in both vertical and horizontal planes; we observed that image brightness drops off rapidly as you move to the side of the screen, but the image remains sharp.

With a native resolution of 1,280-by-1,024, the monitor can

handle resolutions down to VGA. The scaling is extremely effective, and though some characters may look a little fuzzy at



WHAT A VIEW: The TFT8000 gives you the equivalent display area of a 21-inch CRT.

lower resolutions, text and images are readable and have few scaling artifacts. The only problem is that standard lower resolutions use an aspect ratio of 4:3, but a 1,280-by-1,024 resolution uses a 5:4 ratio; as a result,

objects look slightly stretched vertically at lower resolutions.

We tested the display using images created by DisplayMate from Sonera Technologies (www.displaymate.com), and with a few exceptions, the quality was excellent. The on-screen display (OSD) made configuration relatively easy, and the images were mostly rock-steady, though we were not able to remove pixel jitter at all gray-scale levels.

Horizontal and vertical lines were of equal thickness and brightness, and there were no apparent cell defects, which is remarkable given the number of pixels in the panel. The only significant fault was a sudden drop-off

of shades of gray or color at the low end:

The darkest shades were black.

The image is roughly equivalent to that of a 21-inch CRT display, yet the TFT8000 weighs just 20 pounds, in contrast to the 70 or so pounds a CRT weighs.

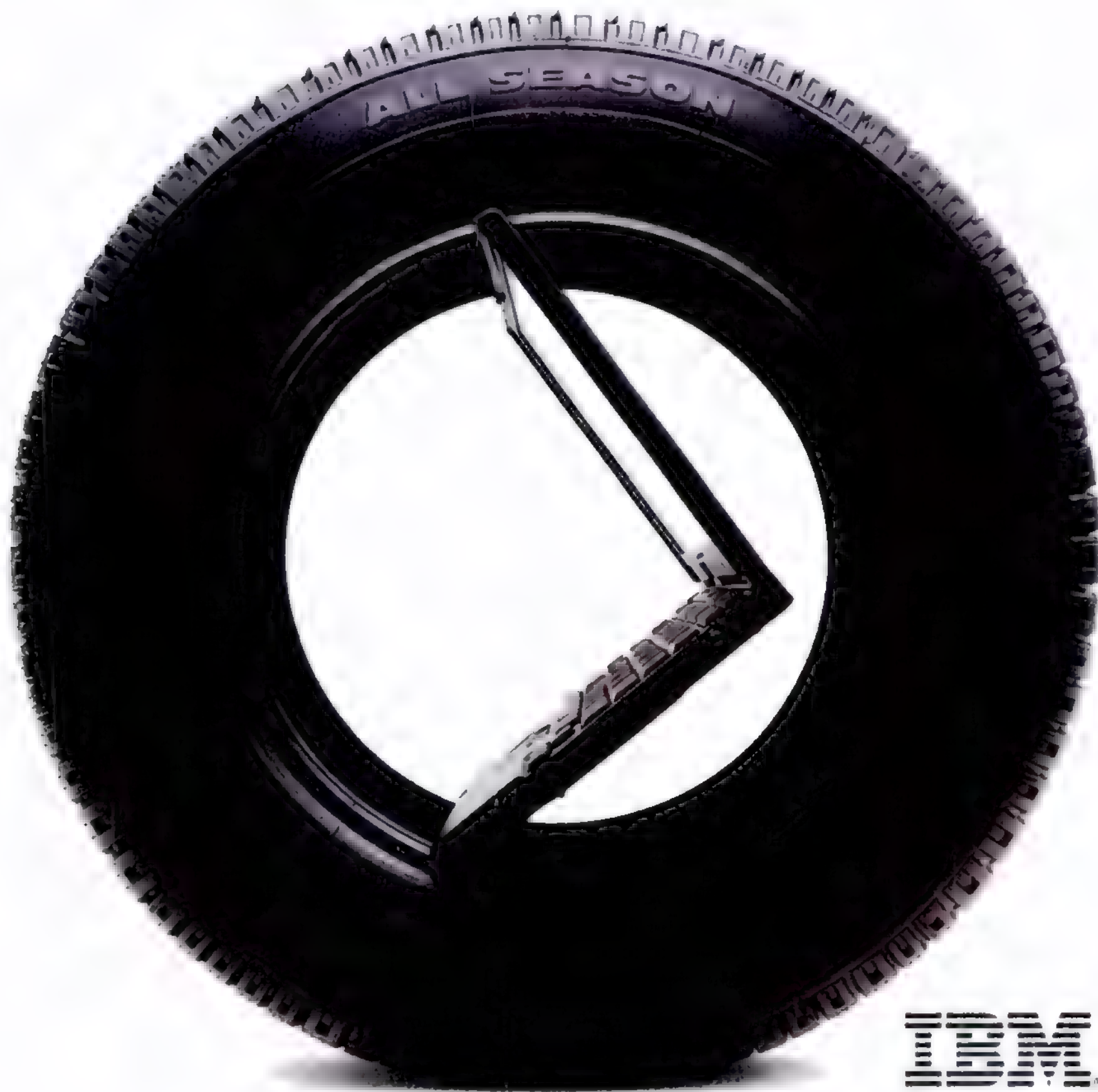
Compaq has targeted the TFT8000 primarily at financial markets where space is at a premium; the monitor is also intended for executive and high-profile applications. Compaq provides a one-year warranty on labor and a three-year warranty on parts, including the backlight.

Since Windows can work easily with multiple monitors, the question of value enters in. Two 15-inch 1,024-by-768 LCD monitors in portrait mode cost less than \$1,000 apiece yet provide about 20 percent more display area and 20 percent more pixels, at a savings of nearly 40 percent.

So although the Compaq TFT8000 is big, bold, and beautiful, there may not be a huge market for it. Users willing to consider spending this much on a display may want to think about some alternatives that will deliver similar results at a lower price. **Compaq TFT8000.** Street price: \$3,200. Compaq Computer Corp., Houston; 800-345-1518; www.compaq.com.



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Utilitize Your Web Portal

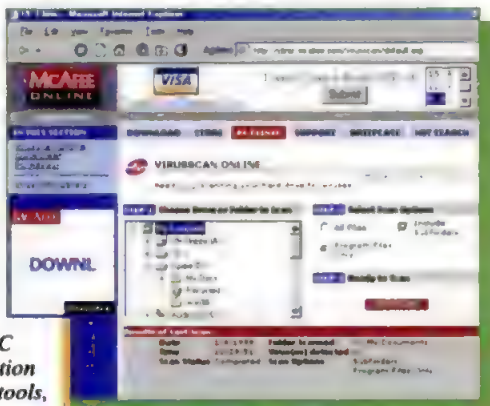
A new "smart" portal from McAfee miniaturizes three popular utilities to use on your PC.

By Josh Taylor

By now you've come to expect news, stock quotes, and free e-mail

from your favorite Web portal. But what about virus protection and system troubleshooting? That's precisely what Network Associates has set out to provide with the introduction of its "smart" portal, McAfee PC Clinic (\$5.95 a month

load—even over a dial-up connection. Once the applications are downloaded, the ActiveX controls run from the hard disk



SIMPLY SAFE: McAfee PC Clinic provides a collection of system maintenance tools, including the easy-to-use VirusScan Online.

or \$49.95 for a year).

The site allows visitors to run McAfee utilities—including the antivirus program VirusScan and QuickClean, a file-removal program—directly from the Web, via ActiveX controls. Currently, *mcafee.com* supports only Internet Explorer 3.0 and later versions on machines running Windows 95 or 98. Compatibility with Netscape's Navigator was promised by the site's official launch, March 1.

BROWSER INTERFACE

Using the browser-based applications was a snap on three out of our four test systems. We ran into problems in only one case, during the download and installation of the VirusScan controls. We ultimately solved this problem by deleting several keys from our Windows Registry and removing the site's cookie from our hard disk.

Because these new versions of McAfee programs use your browser as their UI, the applications' footprints are significantly smaller than those of their disk-based brethren and took less than 5 minutes to down-

(not over the Web) providing performance speeds comparable to the off-line versions.

ONLINE UTILITIES

VirusScan allowed us to specify whether we wanted to scan individual files, directories, or disk volumes. QuickClean let us specify the locations and file types to search for and then produced a list of files that it offered to delete for us. Unfortunately, once QuickClean generated its list, we were not able to pick and choose which files we wanted to delete—it was all or nothing.

A far more serious issue is one of access. When we tested the preview version of the site, it scanned only viruses if you were online and were at the VirusScan page. By the time you read this, the software should always be active, so that even if you're off-line, virus protection will be enabled. But if the software detects a virus, it still must connect to *mcafee.com* in order to clean it, and therein lies our concern.

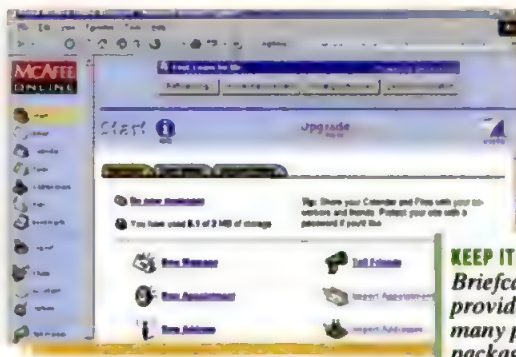
As any Internet user knows,

even the most stable sites (and the best of ISPs) suffer outages sometimes. We're going to make sure we have another antivirus program at our disposal. We recommend you do the same.

Other features of the PC Clinic include PC Advisor, which assists users in system troubleshooting, and Virus Information Library, which provides in-depth information about thousands of viruses. Network Associates plans to expand the site to include Oil Change, the online software-updating program (which should be in place by the time the site launches), as well

as additional components of its First Aid program.

The new portal also features PIM functionality, which Network Associates is providing through a partnership with Visto, the company behind the well-received Briefcase application. With Briefcase, users are



KEEP IT ONLINE: McAfee Briefcase, an online PIM, provides easy syncing with many popular software packages.

service is free even for those who have not subscribed to PC Clinic services.

PORTAL PLUSES

Of course, what would a portal be without news, searching, and shopping? Network Associates has partnered with Snap.com to provide search functionality, technology news and reviews, and shopping and classified listings. The company has also partnered with Beyond.com to operate a cobranded software store. Network Associates plans to announce similar partnerships with online book and music stores, as well as with online brokerage houses and tax preparation outfits.

Our only other gripe with the site is more annoying than significant. Any time we visited the cobranded sections (such as Briefcase and the Snap pages), our browser was forced to spawn a new window. By the time we were done with a visit to *mcafee.com*, we usually had five different browser windows open.

Despite some reservations, we are excited about what the future holds for full-featured applications that can be run over the Web. We are also hopeful that Network Associates will be able to modify fu-

ture versions of at least some of its online applications to ensure that they will operate at 100 percent—whether or not a user is connected to the Web.

McAfee PC Clinic. Direct price: Per month, \$5.95; per year, \$49.95. Requires: 16MB RAM, Microsoft Windows 95 or 98; 408-988-3832; Network Associates Inc., Santa Clara, CA; 408-988-3832; www.mcafee.com; 404 at www.pcmag.com/infolink.

able to upload their e-mail, calendars, address books, bookmarks, and any other files to the Web. Then these same (password-protected) files can be accessed from any other computer with online access.

Users of *mcafee.com* can also synchronize Briefcase with their local PIMs, including ACT, Lotus Notes, and Outlook, for free—a service that would cost \$9.95 per month through Visto's Web site. The

Font Fixer-Upper

With the latest version of Pyrus's FontLab, Windows finally outpaces the Mac in font editing.

By Edward Mendelson

With FontLab 3.0 (\$399 list), a powerhouse font editor from Pyrus North America, for the first time the Windows platform has better font software than the Macintosh. Unlike previous font editors, which were all designed primarily for the PostScript font format, FontLab is equally adept at editing PostScript and TrueType fonts, and it's the only editor that seamlessly imports and exports the "hints" that improve TrueType's on-screen appearance.

For users who don't need FontLab's professional features, there are two other packages: the entry-level TypeTool (\$99 list) and ScanFont 3.0 (\$199 list), which has fewer editing functions but adds automatic transformation of scanned images into fonts. Of the three, only FontLab has native TrueType editing; the other two import and export TrueType formats but can't apply custom TrueType hinting.

Also unlike all other major font editors, FontLab was designed from the start for the Windows platform, and its well-organized interface is remarkably easy to navigate despite its vast set of functions and controls. Multiple fonts can be opened simultaneously, and each is displayed in a tabular set of thumbnail images with its full character set; the characters are identified by name, number, or Unicode symbol number.

To edit characters, FontLab uses drawing tools similar to those in graphics programs such as Adobe Illustrator. There are also special-purpose tools for applying and adjusting the PostScript hints and TrueType instructions that improve a font's low-resolu-

tion printing and display.

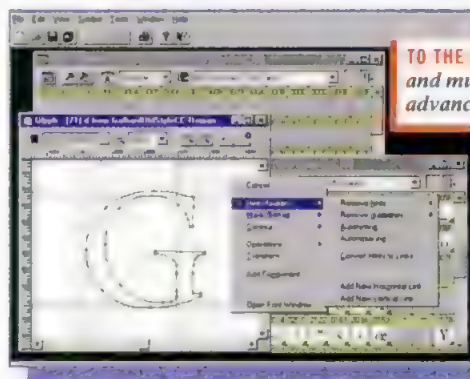
Characters can be drawn in PostScript's Bezier curves or TrueType's quadratic splines, and the program does an impressively exact job of converting between the two curves. Bitmap images can be imported and rescaled for use as background guides. A special window lets you adjust kerning by dragging characters into the correct area.

FontLab makes an easy task of adding or modifying existing fonts or applying hinting to improve the display of unhinted

fonts. But the program also makes it easy to automate complex transformations of one or more characters in multiple fonts. To make a set of standardized changes to a font—thickening a range of characters by a

changes, preview them, and save the script to be used again.

FontLab's only competition is Macromedia's Fontographer, which hasn't been updated since 1996 and has only limited TrueType support. Font designers, graphics artists, and



TO THE LETTER: FontLab's toolbars and multiple windows make advanced font editing easy.

anyone seriously interested in fonts now has a strong product for the PC platform.

FontLab 3.0. List price \$399. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 95, 98, or NT 4.0.

Pyrus North America Ltd., Millersville, MD; 877-366-8522, 410-987-5616; www.pyrus.com; 400 at www.pcmag.com/infolink.

Totally Free ISP

In exchange for your demographic data, NetZero provides you with free unlimited Internet access.

By Bruce Brown

If you're sick of spending \$10, \$20, \$30, or more per month for Internet access, check out NetZero's free ISP service. After you provide basic demographic information, dial NetZero's local access numbers (available in most metropolitan

advertisers' paying for exposure to targeted potential customers. But the company promises never to divulge your personal information or sell subscriber lists.

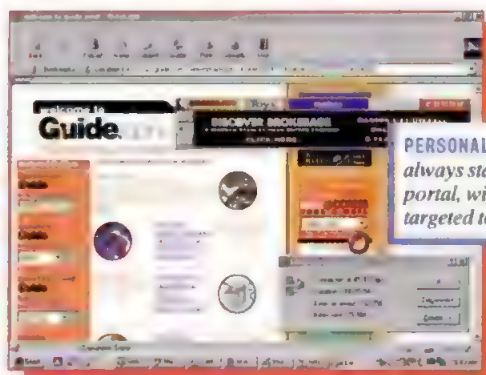
NetZero uses three providers, AGIS, GTE Interworking, and Level 3 Communications, to provide Internet access and to scale up as demand increases. There are currently more than 600 local access

vice and complete your demographic profile (a 2-minute process) NetZero's zCast software runs when you dial in to the ISP, presenting targeted 30-second banner ads. You can move the banner and go on surfing, but you can't delete the ad.

You can use Microsoft Internet Explorer or Netscape Navigator as your browser, but in either case the NetZero connection opens at the Guide.Com portal, another NetZero revenue opportunity. As you browse the Web, zCast tracks the sites you visit to refine your profile further—a potential concern for those who insist on privacy.

An inactivity timer will bump you off after 30 minutes; the company hasn't yet set a limit on connection time. If you prefer anonymity on the Internet, NetZero isn't for you. But if you don't mind targeted ads, NetZero gives you a way to surf for free.

NetZero. Price: Free. Requires: 16MB RAM, 12MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. NetZero Inc., Westlake Village, CA; 888-638-1376; www.netzero.com; 401 at www.pcmag.com/infolink.



PERSONAL PORTAL: NetZero always starts at the Guide.Com portal, with movable banner ads targeted to the user's profile.

numbers. In testing in the Hartford, Connecticut area, we were able to sign on to the service at a variety of hours—including peak usage times—more than a dozen times with only one busy signal. Connection speeds were usually around 40 Kbps.

After you register for the ser-

areas) for a free, unlimited Internet connection. For this free access, you'll have to put up with an ad banner that follows you wherever you surf.

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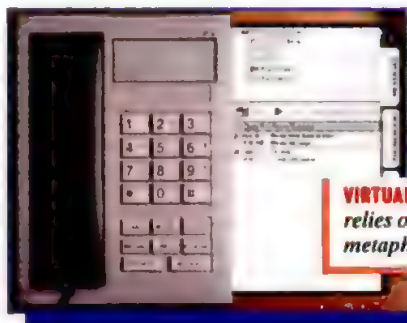
The PC as Secretary

Conversa Messenger helps you achieve almost total hands-free communication.

By Alfred Poor

Wouldn't it be great if your PC could take messages and place calls for you? That's the concept behind Conversa Messenger (\$130 street), a new application based on voice recognition that can help you handle your voice mail, faxing, and e-mail. Despite the program's limitations, you may find it to be a handy productivity booster.

The concept is straightforward: Put on a headset with a boom mike and run all your communications by talking to your computer. The program uses Conversa's continuous-speech recognition, so you don't have to go through any training sessions to get the system to



VIRTUAL PHONE: Conversa Messenger relies on a familiar speakerphone metaphor as its user interface.

recognize your commands.

The interface is based on a standard telephone. Click on the keypad to dial numbers, and you can open a message tray to display contact lists, stored messages, and a log of incoming and outgoing calls. Placing a call is simple: Just say the phone number or the contact's name.

There are many ways to customize the program, including

the creation of up to 10,000 voice mailboxes. You can also create complex greetings using a combination of your own recorded message, musical backgrounds, and sound effects.

The program can recognize voice commands, so your messages can be accessed remotely from any

phone. Call in, then dial your private code to set the program to respond to commands. You are then able to retrieve voice mail and hear notifications about faxes and e-mail.

This package has a few weak spots, though. For example, it does not entirely replace your phone on all systems. An internal voice modem with a speakerphone feature can be wired so that you can use the same head-

set and boom mike both to control Conversa Messenger and to hold your telephone conversations. Otherwise, you must use the modem's speakerphone feature or plug a standard phone into your modem.

Also, the program is designed to work best when you already have a contact list established in a PIM such as Outlook. You may need to rebuild the recognition database to get Conversa Messenger to recognize new entries—a problem we encountered in our testing.

Conversa Messenger is a powerful tool that can provide voice control of many useful communications functions, but it falls short of being a totally automated assistant.

Conversa Messenger. Street price: \$130. Requires: 24MB RAM, 50MB hard disk space, Microsoft Windows 95 or 98. Conversa Corp., Redmond, WA; 888-487-4373; www.conversa.com; 402 at www.pcmag.com/infolink.

Instant Digital Photos

The Polaroid ColorShot combines new technology with half-century-old instant photography.

By Daniel Grotta and Sally Wiener Grotta

Using the Polaroid ColorShot Digital Photo Printer (\$300 street), you can produce photo-quality prints. And with the optional Direct Connect Adapter (\$100 street), you can attach the printer to a digital camera without using a PC. There are a few drawbacks, though: Images are small, media are expensive, and the Direct Connect interface has annoying limitations.

The ColorShot is a brick-size 160-lpi device that uses color LCDs to produce continuous-tone color photographs. Then, as with a consumer Polaroid camera, the exposed sheet of film is ejected, and it develops completely in about a minute.

nect Adapter. Setup is simple and straightforward. We recommend selecting the preview option, which shows you how the image will look. Prints cost a dollar a shot, so mistakes are costly. And the image size is a diminutive 2.9 by 3.6 inches.

As expected, the USB model works almost twice as fast as the parallel unit. The USB printer took an average of 13.8 seconds after downloading to eject the sheet of film, and the parallel unit took 26.4 seconds. Both models produced images with accurate color and detail.

We used the Polaroid PDC 640 digital camera to test the Direct Connect Adapter. First, you install the driver and attach the Adapter to your PC's serial port. The hydraulic cable config-

Next, the driver searches for the COM port and uploads itself to the Adapter. Then you select your camera model and upload that driver. Finally, you disconnect the Adapter's serial cable from the PC and attach it to your camera's serial cable, then connect the parallel part of the cable to the printer.



CONNECT You can plug the printer directly into a camera

The Adapter has four buttons and a status light. One button pages forward through the camera's LCD viewfinder, and the others are for printing a single image, printing all im-

ages, and deleting images. The average print time is 26.8 seconds. Image quality can be disappointing: Pictures are grainy and indistinct, and colors are muddy. The index print's thumbnails are miniscule.

The ColorShot's speed, small size, and ability to run off a car battery may appeal to professional markets such as law enforcement and real estate. But for most users, the same amount of money buys a color ink jet printer that produces prints of similar quality.

Polaroid ColorShot Digital Photo Printer. Street price: \$300. ColorShot Direct Connect adapter, \$100. Requires: 16MB RAM, 50MB hard disk space, Microsoft Windows 95 or later. Polaroid Corp., Needham, MA; 800-343-



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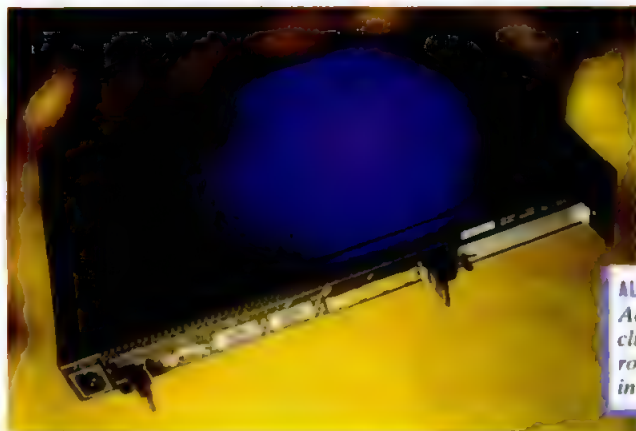
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ALL-IN-ONE: The new IBM 2212 Access Utilities incorporate thin client, VPN, load balancing, and routing capabilities (and more) in one chassis.

Branch Office in a Box

The IBM 2212 Access Utility 10H offers nearly all the network computing your branch office needs.

By Steve Rigney

By the time you install all the necessary thin client, remote access, Virtual Private Networking, routing, load balancing, and encryption hardware in all of your branch offices, you are probably out of both money and space. IBM may have a solution to your problem in the form of the IBM 2212 Access Utility 10H (\$4,400 list for base unit). The 10H incorporates all of the branch office functions listed above into a single chassis.

VARIETY OF CHOICES

There are actually two new 2212 Access Utilities to choose from: the 10H and the 10F. Both include four WAN ports for routing, a built-in serial port, and two available slots for adding options, such as an Ethernet or Token-Ring adapter and a BRI or PRI ISDN adapter. The major difference between the two models is that the 10H contains a 3.5GB hard disk compared with a 48MB Flash ROM for the 10F. With the addition of the hard disk, the 10H is able to perform more functions than the 10F, including the abilities to act as a thin client server, load-balancing device, and TN3270E termi-

nal-emulation server. Both units come housed in a 19-inch rack-mountable chassis, and each costs \$4,400 for the base chassis. We chose to look at the 10H because of the added functionality for the same price.

The 10H performs many functions, so it is necessarily complicated to set up and configure. You have a choice of either a graphical Windows configuration utility or a terminal-emulation program via a serial connection to initialize and configure the unit. After a couple hours of trial and error with both types of configuration, we were able to make the 10H perform as intended.

A third option is remote configuration using a dial-in modem attached to the unit's serial port. This is important for any branch office solution.

JACK-OF-ALL-TRADES

The remote access and VPN capabilities are the most useful of the 10H's many features. Remote access is available using the optional Dial-In Access to

LANs (DIALS) feature. DIALS works with internal ISDN adapters to allow remote users to dial into the LAN and local users to dial-out across the LAN to other services, such as the Internet. Other DIALS features include usage tracking and effective security settings.

For now, remote access only works with ISDN connections, but IBM plans to ship an analog modem adapter by June.

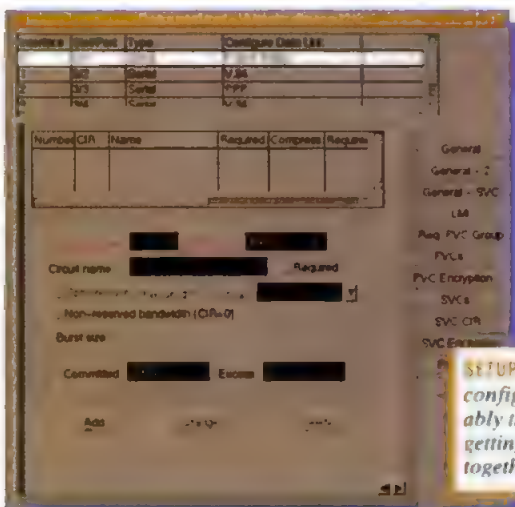
The 10H offers all of the VPN functions you need including authentication, encryption, and tunneling. Authentication is available in the form of

more secure than L2TP, but L2TP lets you tunnel other protocols besides IP, such as IP or AppleTalk. We find that the 10H's combined solution is best.

THIN SERVER USES

The thin server functions in the 10H are useful only if you have Network Stations (NSs) attached to your LAN. Normally NSs connect to a host, such as an AS/400 or other midrange system, in order to boot-up and function on the network. If dozens of NSs attach to the host at once, system performance can slow down. Likewise, if the host is situated at another location, expensive long-distance connections may be necessary to connect NSs located at branch offices. The

10H can work as a surrogate host to let the NSs boot up and access files and applications. You'll still need a connection to the application servers, but the thin server utility can cut down on remote traffic and the load on the host computer.



SETUP A graphical Windows configuration utility is probably the easiest option for getting everything to work together as intended.

the IP Security (IPSec) protocol and a built-in authentication, authorization, and accounting (AAA) server. Encryption is available in software using IPSec but is faster and more effective using an optional \$3,000 Compression Compact PCI adapter. This adapter performs hardware encryption and compression to increase performance. Tunneling is available using both the IPSec standard and the Layer 2 Tunneling Protocol, both of which are built into the 10H's software. The IPSec protocol is

The built-in WAN ports allowed us to set up the 10H to server as either a bridge or a router between different LAN segments. The 10H works with multiple protocols including AppleTalk, Banyan Vines, DECnet, IPX, NetBIOS, and TCP/IP. Because the 10H is an IBM solution, it also provides support for SNA connections to a centralized host mainframe.

IBM 2212 Access Utility 10H. List price: For base unit, \$4,400. IBM Corp., Armonk, NY; 914-765-1900; www.ibm.com; 902 at www.pcmag.com/infolink.

Beyond Y2K

Zero Administration Client 2001 proves that it's more than a one-bug fix.

By Greg Alwang

Network Associates Inc. (NAI) has broadened its view of the Y2K problem with the release of Zero Administration Client (ZAC) 2001. For as little as \$17 per node, ZAC 2001 offers an affordable solution for evaluating Y2K risks and can add network management assets to your enterprise.

ZAC 2001 supports clients running DOS or Windows Version 3.x and later, including Windows NT 4.0. The server components require NT, NetWare NDS, or a Bindery-based server. For multi-NOS enterprises requiring scalability, ZAC 2001 can be distributed on various NetWare and Windows NT servers, and a central site server can consolidate inventory from several member servers.

ZAC 2001 nearly installs itself, and we had it running on our Windows NT server and inventorying our

TAKE A PEEK: Spy inventory details and accesses Y2K compatibility issues.

desktops in less than half an hour. The SiteInventory and Alert Manager services (or NetWare Loadable Modules) handle the chores of gathering inventory and notifying administrators of unauthorized inventory changes or Y2K-compliance breaches. The SNMP-based traps generated by ZAC 2001 can be detected by most enterprise-level management applications. ZAC 2001 also integrates with full-blown help-desk suites.

ZAC 2001's inventory agent

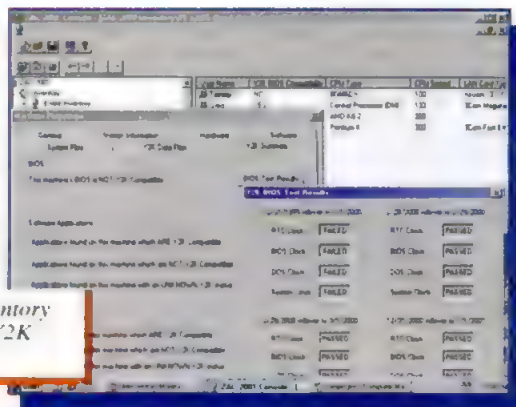
works by testing client PCs for Y2K BIOS compatibility and scanning local hard disks for applications. If a BIOS is noncompliant, the agent automatically installs a terminate and stay resident (TSR) to fix the problem. Inventoried software applications are compared with a database of over 6,000 desktop applications. Updated monthly, the software database is available for download via Network Associates' Web site at www.nai.com.

In addition to applications, the inventory agent scans MS Office spreadsheets and databases. Unlike Norton 2000's data scanner, ZAC 2001 requires Excel to be installed on the client to fully scan spreadsheets.

The Explorer-like ZAC Console is used to manage enterprise desktops and access the 27 preconfigured

inventory reports. NAI also includes a full version of Crystal Reports 5.0 with ZAC 2001, letting you build an unlimited number of custom reports for both management and technical staff.

Zero Administration Client 2001. List price: Per node for 3,000 nodes, \$17; per node for 50 nodes or fewer, \$27. Network Associates Inc., Santa Clara, CA; 408-988-3832; www.nai.com; 900 at www.pcmag.com/infolink.



Back Up, Boot Up

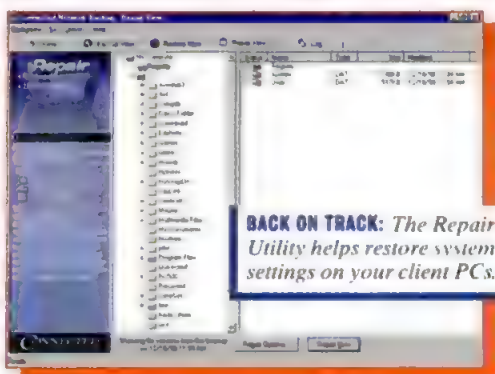
Connected Network Backup 4.0 boasts new features to simplify the task of backing up client PCs.

By Steve Rigney

The last time we looked at Connected Corp.'s backup software, Connected Network Backup (PC Magazine, August 1998), we had some concerns about the high cost and hardware demands that limited it to large enterprises. The new version, now called Connected Network Backup 4.0 (CNB; \$6,000 list for the server, \$149 for each client), has answered many of these concerns and offers several other surprising improvements.

Perhaps the best new feature in CNB is Save Once. This setting is enabled during the installation and lets you keep only a

single copy of a common file or directory on the storage server. For example, if you send a Word document to 25 users, CNB will back up that file only once and only monitor for changes to the



subsequent copies. This saves on needed disk resources and backup times. Competitors provide similar capabilities.

The new feature Point-in-

Time Repair (PTR) is equally appealing and even quite distinctive. PTR lets the CNB agent residing on the client PC take a snapshot of all of the PCs settings. If the client PC's hard disk crashes, you can simply reinstall the OS, start the network connection, and CNB will restore the settings. This feature also works well for application problems. For example, we deleted several files that Microsoft Office needed in order to launch. When we tried to launch the application, the CNB automatically found the missing files and restored them.

Hands Free Backup is the remaining new feature of CNB. Designed for remote users, this feature will automatically back up data whenever it senses a connection to the network. This is handy for travelers who con-

nect to the network infrequently. Best of all, if the connection is broken before the data is sent to the CNB server, the product will remember where it left off and send the remaining data the next time a connection is made.

We were delighted with CNB's new features and pleased that its list price dropped (to as little as \$105 per client for a 500 or more user license). But competing products such as Core-Data, RemoteWorx, and Seagate Client Exec remain less expensive and feature similar functionality. With that said, CNB is a great tool for medium to large businesses that want to offer online backup and restore for all their client PCs and remote users.

Connected Network Backup 4.0. List price: Server, \$6,000; each client, \$149. Connected Corp., Framingham, MA; 800-353-3078, 508-270-0000; www.connected.com; 901 at www.pcmag.com/infolink.

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Network Treasure Chest

Microsoft BackOffice SBS 4.5 offers nearly every small business network function available.

By Les Freed

Microsoft is marketing BackOffice Small Business Server 4.5 (SBS) as a software bundle that provides virtually everything that a small business needs to get started in networking. The package (currently in beta; price to be announced) lives up to this marketing hype by including a smorgasbord of Microsoft products, including Exchange Server 5.5, Fax Service 4.5, FrontPage 98, Internet Explorer 5.0, Modem Sharing Service 4.5, Outlook 2000, Proxy Server 2.0, SQL Server 7.0, Windows NT Server 4.0, and in one of the two versions, Microsoft Office 2000 Professional. We tested a public pre-release of Version 4.5 with Office 2000; Microsoft claims the final release version will be available no later than the second quarter of this year.

INS AND OUTS OF INSTALLATION

The entire SBS package installs at one time using a new wizard-based setup engine. The installer provides modem installation and hardware detection options that aren't available in the standalone Windows NT Server installer, and it allows you to spread the 3GB of installation files across several hard disks if necessary. Despite the simplified setup engine and the small business focus of the package, Microsoft estimates that about 90 percent of all SBS installations are still performed by a VAR or technology consultant, usually as part of a new PC or small network solution purchase.

It's important to note that SBS must be installed as a "clean install" on your server PC: The SBS server must be the Primary Domain Controller (PDC) on your LAN, and the install will fail if another PDC exists on the net-

work. SBS creates its own private IP network addresses, and the SBS client PC installer uses those addresses to communicate with the client PCs. Installation of the full package—including Office 2000—takes about 4 hours, even on a fast server.

Also note that SBS uses Windows NT Domain Security, so all users and client PCs must have an account on the server. This will be a major change for those who have been using Windows 95's File and Print sharing services.

SBS provides users with easy access to system administration and maintenance via the SBS Console program. The SBS Console lets users manage user accounts and passwords, client PCs, and

py disk containing a setup program and configuration files for each PC on your LAN. To set up the client PCs, you boot the client PC and then run the setup program from the floppy disk. The Client installer renames your existing PCs and modifies the network settings to use the SBS server as the IP gateway, Proxy Server, and DHCP server for the entire LAN.

Once you've configured your

SBS also includes Microsoft Exchange Server, which can handle incoming and outgoing Internet mail, but this feature works best if you have your own Internet domain name. Small businesses may find it simpler to purchase multiple POP mailboxes from their ISP. The Outlook 2000 mail client works with Exchange or public POP mail servers, so you can start with POP mail and move up to Exchange-based mail as your needs dictate.

NEW FAX FUNCTIONALITY

The Microsoft Fax Sharing

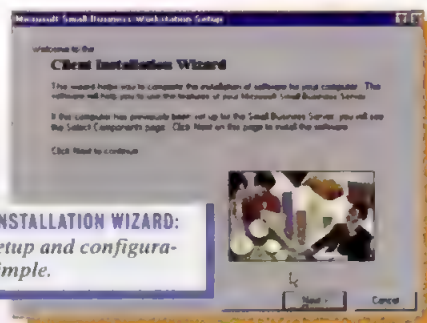
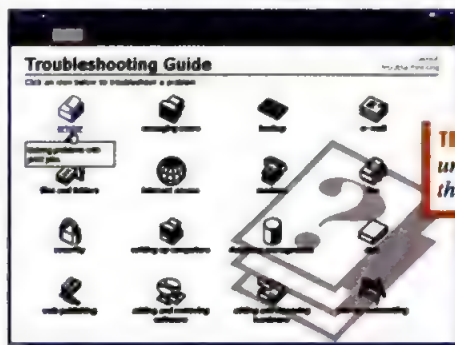
TROUBLESHOOT: Easy-to-understand icons walk you through network problems.

ing service provides basic outbound fax transmission via a shared modem. All incoming faxes can be routed to a specific

LAN printer or to a specific Exchange mailbox, but SBS doesn't provide inbound fax routing as do dedicated LAN fax programs. It's possible to use one modem for both Proxy Server and Fax Sharing, but heavy fax users will likely need a second modem and a dedicated fax line.

Microsoft hadn't announced final pricing for SBS as we went to press, but we expect the price to be similar to that of SBS 4.0. At \$1,499 (list) for 5 workstations and \$2,459 for 25 workstations, SBS 4.0 provides a full suite of LAN-based services at a reasonable price, and the new version does the same. Microsoft's Preview program lets prospective users try the software for 120 days at minimal cost, but be aware that the preview version can not be upgraded to the final release of SBS: You'll have to sit through that 4 hour installation all over again.

Microsoft BackOffice Small Business Server 4.5 (beta). List price: TBA (free upgrade for existing SBS 4.0 users.). Microsoft Corp., Redmond, WA; 206-882-8080; www.microsoft.com; 903 at www.pcmag.com/infolink. 



CLIENT INSTALLATION WIZARD: Client setup and configuration is simple.

shared resources (files, printers, and access to the Internet and fax sharing services) via a simple browser-based interface. The SBS Console also serves as an early warning system, displaying a bright red bar with descriptive error messages when some part of the system isn't working properly.

CLIENTS AND SBS

Each PC must be configured to work with the SBS server before it can communicate on the LAN. When you use the SBS Console to create new PC accounts on the SBS server, it creates a floppy

client PCs, you use the same SBS Console to create user accounts on the server. As part of the user-creation process, you tell the SBS

Console which PCs each user can use, and which applications each user needs to use. When that user logs in from a client PC, SBS checks to make sure the specified applications are installed on that PC and will install them if necessary. Depending on the options you select, each client PC will require at least one reboot. SBS supports Windows 95, Windows 98, and Windows NT Workstation (but not Windows NT Server) 4.0 clients.

SHARE THE NET

SBS provides shared Internet access via Microsoft Proxy Server 2.0, letting you share a modem, ISDN, cable modem, or DSL connection over the LAN. We tested Proxy Server with both a 56K modem and a cable modem connection; both worked flawlessly.

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Videoconferencing: Waiting for DSL

By Jan Ozer

When Internet videoconferencing arrived in 1996, it was characterized by quirky, low-performance hardware and limited-feature, incompatible software—a bad combination, which was exacerbated by poky Internet connection speeds. If you could connect at all, video quality stank, with distracting visual artifacts, achingly slow frame rates, and unsynchronized audio. As a result, although hobbyists and enthusiasts embraced Internet videoconferencing, few wanted to jump on the bandwagon.

Since then software standards have coalesced, mainly around Microsoft NetShow and White Pine's CUSeeMe, ensuring compatibility with remote users. And connection servers have eased connection problems.

Over the same period, video cameras have migrated from the limited-bandwidth parallel port to the much faster Universal Serial Bus, as well as PCI card and PC Card connections. In addition, the tethered digital video camera market is now dominated by mainstream players (such as Intel and 3Com), ensuring competitive pricing, ease of installation, rich product bundles,

and a voice at the other end of the phone when things go wrong.

Unfortunately, outside of colleges and 10Base-T-fueled corporations, Internet connection speeds remain modest. Except for the relatively few consumers lucky enough to have cable modems or DSL, bandwidth has at best jumped from 28.8 Kbps to 56 Kbps—usually only if the stars are aligned correctly.

This largely negates the increased video bandwidth provided by today's cameras. Al-



though the compression algorithms that shrink the video for Internet transmission have improved, video quality at 40 Kbps to 56 Kbps is still very visibly degraded.

As our readers testify, imperfect video is often quite good enough for a glimpse of a friend, spouse, or child separated by time and distance. And high-bandwidth help is coming in the form of DSL and cable modems, with a sprinkling having been installed in 1998 and even more on its way. These higher-speed connections will boost video quality beyond that of today's ISDN-based corporate systems, and they will inevitably broaden the appeal and penetration of Internet videoconferencing.

To CE or Not to CE

By Bruce Brown

As expected, reader comments on Windows CE H/PC Pro devices reflected comparisons with notebook PCs, swinging both ways in the traditional balancing of price, portability, and power (although of those who remarked, none seemed to have their own H/PC Pro machines).

The additional functionality of the H/PC Pro hand-held devices—including bigger color displays and keyboards—means more of you are considering them for on-the-go productivity. But with street prices around \$1,000, it's easy to see why you wonder if spending a few hundred dollars more for a new notebook might be worthwhile.

As we originally stated ("Windows CE, Round 3," December 1, 1998), H/PC Pros retain their role as companions to conventional Windows PCs. You can see more on the screens of H/PC Pros, and they're easier to type on than earlier models, but those features make them better suited for document or image perusal and for note taking.

The greatest advantages of



the H/PC Pros over notebook computers are battery life, durability, and instant-on access to applications and documents. A lack of moving parts also means greater durability.

There weren't any negative comments about touch screens, though not all H/PC Pros come with this style of input. Users looking for an alternative to a notebook PC appear to prefer touch pads; people used to hand-held devices generally prefer and expect touch screens.

One of you inquired whether touch screens will ever be used on notebooks. You can purchase after-market products to overlay notebook displays and make them touch-sensitive. But in the absence of a great demand from users, it's not likely major manufacturers will offer them.

As one of you noted, Windows

9x pen-based PCs are available, but pen computing has not taken off. The identical Sharp Mobilon Tri-Pad and Vadem Clio offer an attractive alternative to traditional pen computing: You can fold their screens and keyboards into a tablet format to take notes.

Still best as PC companions, the Windows CE H/PC Pros are an intriguing option for people seeking portable data access without full application power.

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Tell us what you think...How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of videoconferencing.

I use videoconferencing to talk with my girlfriend, who lives 2,500 miles away. Although her connection is only a 28.8 modem, whereas mine is ADSL (1.1 Mbps speed), the quality is passable. True, there's a lot of lag and it's probably only about 10 fps, but considering the fact that sometimes all you need to see is someone's face, videoconferencing is definitely a great idea.

—Kenneth

Videoconferencing is here, and the only problem (as with most things on the Internet) is that not everyone has the bandwidth to enjoy it. Once cable modems or DSL become ubiquitous, videoconferencing can truly take off, which will result in higher quality cameras, more rapid development, and so on. It's like the chicken and the egg, but here we know bandwidth has to come first.

—Will

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Chip IDs: Nothing Personal

From the furor, you'd think that the Pentium III was made of radioactive anthrax. In late January the trade press found out that each Pentium III would carry a unique processor serial number, which could be output on receipt of the proper instruction. The civil-liberties groups and watchdog organizations

reacted—and overreacted—swiftly. While some voiced valid concerns about incursions into consumers' privacy, others assumed (erroneously) that this number would be available to all online transactions, that it would be necessary to register your hardware in order for the number to work, and that this would tie the number into software registration. All called for a massive boycott of Intel.

Intel didn't stonewall; the original Pentium floating-point problem was evidently a lasting lesson. Within days, the company announced that the Pentium's serial number (the PSN) would be defaulted off at boot-up, and the company would make available a utility program to turn it on and off.

Privacy advocates fear that marketers will be unable to resist building databases of IDs and individuals across sites. Once demographic companies start profiling your activities at retail, news, banking, chat, and sex sites, they know too much about you. Today, you can maintain a level of anonymity and avoid the kind of laser-targeted promotions that marketers dream of, but which in reality just annoy most consumers. (Anonymity, by the way, is deeply rooted in the cash transaction. Your money is all the credential you need and all the seller needs to know about you.)

I think the PSN is a good idea. A serial number can serve as a public key and as the foundation of a secure-transaction system that proves you are who you say you are. Certifiable identity is crucial to many forms of electronic commerce and for access to corporate networks and other servers that contain proprietary information. Along with Intel's planned processor-based random-number generator, the PSN can be used for a variety of encryption and decryption tasks.

Intel's implementation, however, doesn't go far enough. Given the right instruction, the chip simply blurts out its serial number to the requesting software program. If your Web browser is doing the requesting, it can report the PSN to the site you're accessing. One obvious flaw in the design is that we increasingly do our online transactions from multiple PCs, which renders the PSN pointless or creates

a much larger task for those who would consolidate and cross-reference our activities. It's also highly likely that the PSN request can be spoofed by software designed to intercept the instruction and substitute a fabricated number.

Will you have to register your system before you can use it? Unlikely. Any vendor that attempted to force users to register their systems would probably be met by plummeting sales. Will software registration be tied to the PSN? Only as an option, perhaps as a theft deterrent. The older-processor and non-Intel markets are far too large for software vendors to insist on Pentium III—only customers. Likewise, click-hungry Web sites cannot afford to limit viewership to those with PSN-capable machines.

Could the PSN be used as a theft deterrent? Possibly, but only with additional software hard-coded into a machine's ROM. Software that enables a stolen machine to "phone home" already exists, but to be truly effective, firmware is necessary to shut down the machine or to report its whereabouts. Anti-theft technology works well for car radios and could work well for PCs, but workable schemes are more likely to be tied to voice recognition or bio-scanning technologies such as the Digital Persona U.are.U fingerprint scanner than to the processor ID.

Is the PSN useful to corporate IT managers? Definitely. Controlling the access and activity of specific machines as well as specific users is increasingly important. The PSN will help prevent "machine drift" and will be a boon to accurate inventories.

Finally, Intel has a vested interest in serializing its processors. We don't hear as much about gray-market chips as we used to, but internal serial numbers will thwart gray marketers who mask their identity by grinding lot numbers off chips.

Will a PSN invade your privacy? Probably not. Your system is awash in unique numbers already. Registration codes from Windows and applications are tucked away in the Registry and in other files. Various add-in boards and chips have identifiers; no two have the same number. What's one more? **PC**



A serial number can serve as the foundation of a secure transaction system. I think it's a good idea.

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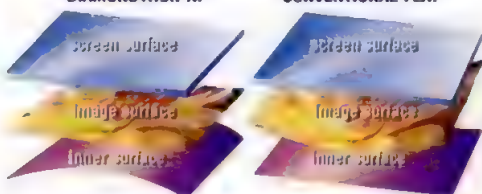
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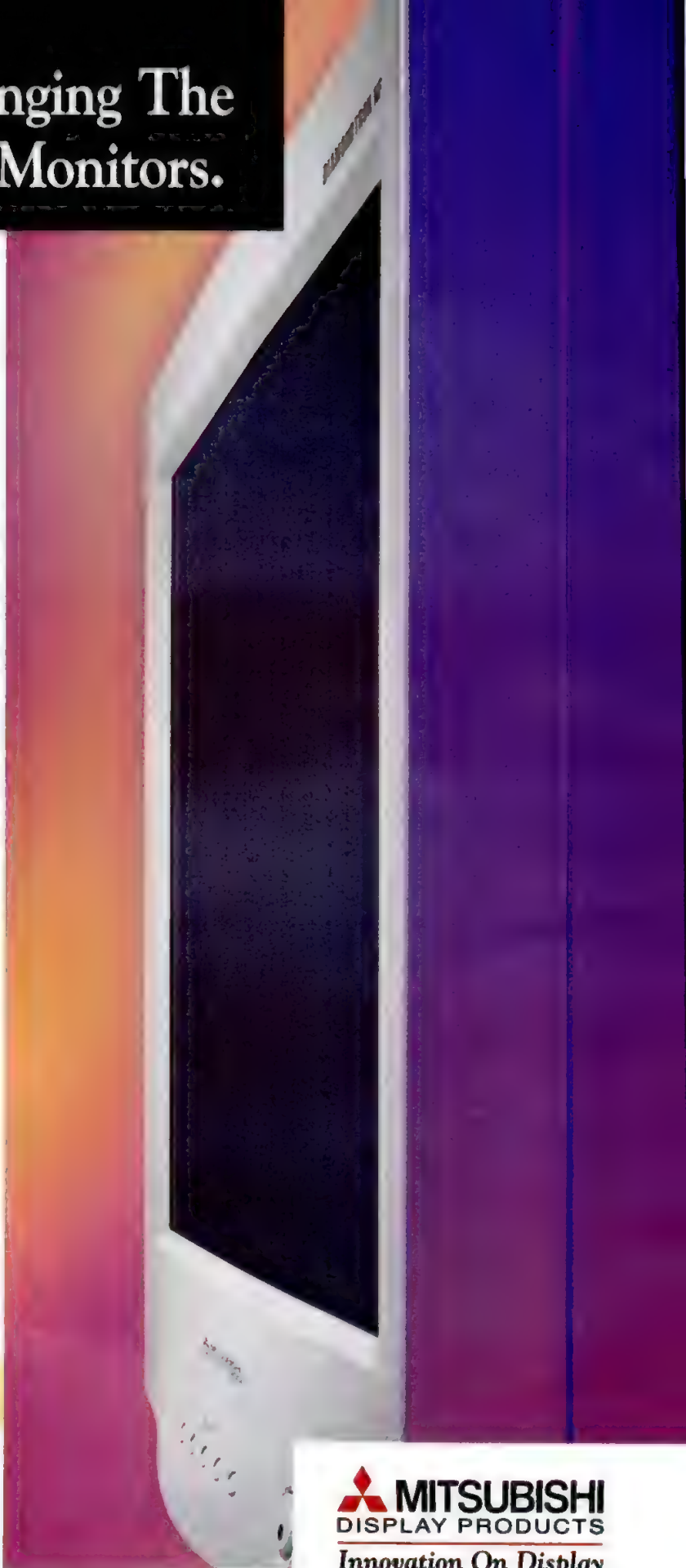


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I Take It Personally, Bill

Despite the arguments of my colleague Bill Machrone, embedding serial numbers in processor chips is possibly the worst idea Intel has ever come up with. If this had been done 20 years ago, when serial numbers were suggested by more than a few people, an understanding of how to live with them

would have been worked out. It's too late now.

The software industry has been whining about piracy forever, although many (myself included) argue that most piracy is really a marketing tool. The first dominant word processor, WordStar, was largely a phenomenon of piracy. People would pass it around and then eventually buy a copy if they found it useful. The lost sales attributed to piracy never account for these conversions. They also don't consider the guy who pirates a product and then finds it useless and never uses it. If forced to buy it, he would have been a complainer; if he had done his homework, he would never have bought it in the first place.

What would it have been like in a pirate-proof world, where chips were serialized back in 1988? Why didn't Microsoft and others demand Intel embed serial numbers back then—or before? A serial-numbered computer with install software that could work only on that PC would have ended piracy once and for all. But this would have made people think twice about their purchases. They wouldn't have had bootleg copies to play with. And the shareware folks, with their liberal attitudes about letting you buy a product to use on your desktop and laptop and your 10-year-old's computer, would have won the marketing war. How many people want to buy multiple copies of everything?

So now, over 20 years after the invention of the microprocessor, Intel has decided to serialize its chips. The company figures this is a way to track down stolen and reclocked chips. In the process, it has invited online sites to spy on customers in ways never thought possible. The timing of this idea is just plain bad. Before the Internet, fears brought out by serial numbers on processors did not exist; now they do.

Let's back up and look at Intel's rationale. Track down stolen chips? How about keeping the chips from being stolen in the first place? Are they being stolen directly from Intel? If not, then why should the company care? Besides, this type of crook will be long gone by the time a chip makes it into a computer.

And what's the big deal if people reclock their

chips? "It gives us a bad reputation when a reclocked system fails!" says Intel. What a load. Yeah, the company is about to go broke from the bad reputation it's gotten over the last 20 years from reclocked chips. Get real! Nobody cares.

How about this instead of a serial number? Embed the clock-speed parameters in the chips! Oh, wait—that won't work, because these are all the same chip, and they're bin-sorted by postmanufacturing tests. Heaven forbid the public discover this dirty little secret; people may try reclocking their chips themselves! Shhhh...don't tell anyone.

Anyway, this is beside the point. At this juncture, with everyone connected, nobody wants to be tracked like a dog. And being tracked is what will happen. Let's say you make the mistake of visiting a porn Web site. You go in anonymously, but your serial number ends up in a database. A month later you go to an innocuous airline site and give your name and address for 500 frequent-flier miles. Your serial number is kept someplace. The databases are merged.

How long will it be before you're in a database (with both your name and your address) as someone who likes porn? You may have accidentally visited the site. You may love porn but prefer to keep your "hobby" a secret. No matter. And the problem goes farther than porn. Say you visit a site that's political or pro-flat tax or whatever. Next thing you know you're audited. Am I paranoid? You bet. And don't think hackers won't get ahold of these numbers and create all sorts of havoc. "I didn't buy that!" "We have proof it was your computer that ordered it!"

Of course, the initial users of this information will be the marketers who want to sell you something. They'll know your exploitable personal habits. These folks are just plain sinister.

Intel assures everyone that there will be a software blocker to help protect privacy, and I'm sure PC Magazine readers know the value of such a thing. But like refusing Web cookies, it will somehow become a huge hassle. Intel should rethink this entire strategy.



At this juncture, with everyone connected, nobody wants to be tracked like a dog.

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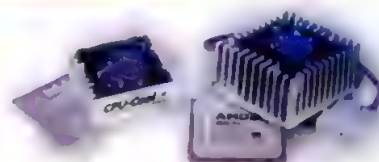
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John C. Dvorak's



INSIDE TRACK

What's the **status of Direct Rambus** and the next batch of **super-fast** machines requiring the use of this incredibly high-speed technology? Well, we're already hearing of **shortages**. Intel is going to invest \$100 million in Samsung in hopes of increasing production, but this looks as if it's shaping up to become part of the never-ending **up-and-down cycle** in memory prices. This is happening just as many of us had hoped that the roller-coaster ride was over. It's believed that 30 percent of new PCs this year will employ the technology, and over 50 percent will do so in the year 2000 (or is that 1900?). Intel has already invested \$500 million in Micron for the purpose of creating an additional supply of Direct Rambus parts.

I'll be interested to see how Direct Rambus improves the performance of Intel-based machines. Right now, I find that even the fastest machines have so much power management employed that power-up latencies are more than a little **annoying**. This makes the machines seem a lot more sluggish. What's the point of **raw speed** when everything is shut down most of the time?

Anyway, there will be Direct Rambus shortages, and Intel has invented a substitute memory module called the **S-RIMM**. Rambus machines use what is called a RIMM (Rambus In-Line Memory Module); the S-RIMM uses more widely available SDRAMs to meet memory requirements. Users could upgrade later if they need the performance boost.

What Are They Thinking? Dept.: I was fascinated by the huge media reaction to Sun's announcements regarding **Jini**, its microcontrol language that is supposed to **revolutionize the home**. How soon people forget. The seemingly **defunct Microsoft At Home** was perhaps a better implementation of the same thing.

The venture-capital community now tells me it's jazzed on the idea of **Internet appliances**: products that have IP addresses and can be controlled remotely. In the demonstration and subsequent stories, Sun cited two items. The first was a **networked coffee-maker**. Company reps showed that it could have your coffee ready when you arrived home—if it was somehow aware of your approach by telemetry or by your sending it a signal.

I saw this Internet-ready coffee machine repeatedly, and I was baffled. Why wasn't anyone laughing? Does this coffee machine fill itself with water and coffee? Does it magically steam milk and add sugar or honey? What does a coffee machine do anyway? Boil water. For this we need the Internet? **I have a suggestion** for anyone designing an Internet-ready coffeemaker: Call it the "Mr. Get-A-Life."

The concept got even more laughable as the media fell all over itself over another idea Jini will exploit: an Internet-ready appliance (such as a dishwasher) that will **diagnose its own prob-**

lems. It will also be able to send a message over the Net to a repair center and have repairs begun before the owner knows what has happened. Huh? Have any of the people at Sun ever owned a dishwasher? Apparently not. When something breaks, it's a knob or a little spring someplace. Maybe a cog fails. So exactly what telemetry methodology is going to be employed to isolate these failures?

To isolate failures, a dishwasher would have to be **reengineered from scratch** with IP connectivity in mind. This means expensive sensors throughout the unit. The dishwasher is going to cost more than a new Volkswagen. Then there has to be a repair infrastructure and headquarters assigned to monitor this dishwasher. How does that work? Can people in Des Moines be sure there will be a nearby Internet-ready repair shop for their new overpriced dishwashers? Is anyone at Sun familiar with the repair business in the first place? Hint: It's pre-information age.

All this is part of a **new network mania** that's sweeping the world. The thinking goes, "If something can be networked, let's network it. The only limitation is our imagination." The real limitation is practicality. Just because you can do something doesn't mean you should do it. Reality checks are in short supply in Silicon Valley nowadays.

Everyone thinks the networked home is going to be **the next big thing**, when the only real reason for it is so the whole family can share the same ISP to get on the Net once in a while. Too many technologists have too much money and too many dweebish ideas, like home networking the coffeemaker. They think it's cool. The fact is these devices are impractical and not worth the expense. One also imagines a lot of needless repairs and scams. "The computer reported a failure, so we came out and fixed it. Here is your bill for \$200." Just buy a Maytag and forget the hassle.

The real thrust of practical IP R & D should not be ovens with IP addresses but IP telephony—**the real next big thing**. Most users know that universal IP telephony service is impractical on today's hop-ridden, backbone-bottlenecked **information dirt road**. Most insiders know that it's just a matter of time before the dirt is paved.

The concept of new classes of IP is getting a lot of attention. The idea is to **develop quality-of-service mechanisms**, whereby the Net can somehow sort and tell the difference between a voice-over-IP connection and a noncritical data transfer. Voice needs extra attention to function properly. There are numerous proposals battling to become the new IP feature to resolve quality-of-service issues. Much of this assumes that, at some point in time, switched circuits will fall by the wayside and packet technology will take over. In a perfect world, maybe. In the interim, look for the development of new hybrid switches that can handle all sorts of connections at once. **PC**

*What does a coffee
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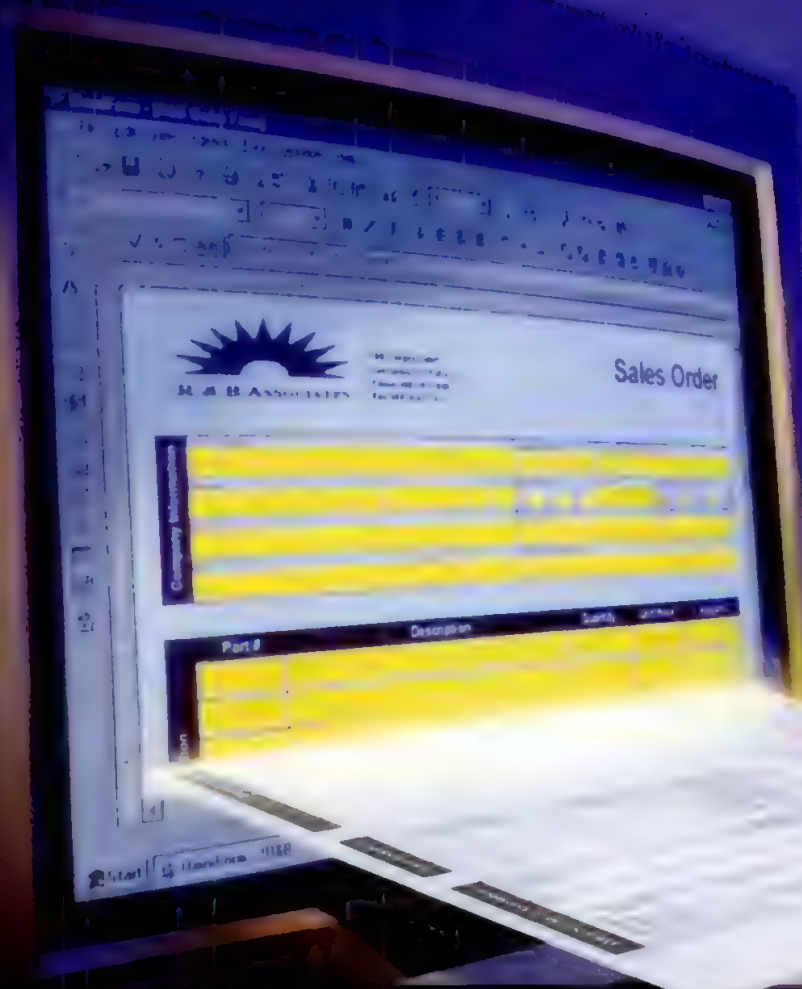
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Be Still, My Foolish...Modem

I should begin by warning you that I'm afraid this is a column you're going to be reading again and again. Remember that when you see pretty much the same story from time to time—here in *PC Magazine*, in other magazines, in newspapers, or on TV shows. Because I'm suffering from a highly infectious

disease, which is spreading like wildfire among those interested in PCs and in the Web.

The start of the infection is marked by a singular act: We get broadband access to the Web.

Then we start spending even more time—*too much time* being the previous state—on the Web. We begin calling and e-mailing our friends, relatives, colleagues, and coworkers, first enthusing to them, then before long berating them for their delay in joining us in our highly connected state.

Then, in the terminal stage, those of us with access to some form of public forum—columnists, sure, but also TV anchors, newspaper feature writers, and others—feel compelled to start writing and broadcasting about how Broadband Changed My Life (which, as “BCML Syndrome,” may become the official term for this disease).

Preliminary research, not yet reported in the *Journal of the American Medical Association*, suggests that a later, probably inevitable mutation produces a state called No Longer Fast Enough (headed for the journals as “NLFE Syndrome,” I suspect). Researchers are on the path toward controlling both forms but warn that a cure is unlikely: This contagion will soon reach epidemic stage across the U.S.

A couple of issues back, *PC Magazine* editor-in-chief Michael J. Miller noted in his column that the mainstreaming of the Web has changed so much: e-mail over snail mail, the appearance of newsgroups and chat sessions, online research and entertainment, e-commerce, and more (“The Net Changes Everything,” February 9, 1999). I say, “Yes, yes, Michael—but you didn’t go far enough. It should have been ‘The Net Changed Everything... and, Fueled by Broadband Access, Will Change Everything All Over Again.’”

Now I have to confess that I was not a fast-Web-access neophyte. As so many *PC Magazine* readers recount in their e-mails to us, I too used to go back to my office at night, or just stay late, after any reasonable person would have gone home, to get on the Web using the office’s T1 line. Fast, sure. About 1

Mbps. But inconvenient and unsustainable (at least, if you have a family—or even just a life).

As much stuff as I buy over the Web, as much research as I do, as much as I’m on the Web at work, there was always so much I *didn’t* do from home—or did just a little of, bailing because I couldn’t wait for all those pages to creep down onto my screen. Access time was the issue: At 28.8K, 33.6K, even 53K, maybe even with bonded ISDN at 100 Kbps—plus, or using jury-rigged shotgun arrangements with two modems and multiple ISP accounts, the Web just wasn’t fast enough.

It was cool, it was helpful, it was...*slloooooow*.

What I had grown used to at work had, in a sense, spoiled me. I knew it didn’t *have* to be that slow, not by a mile. But I don’t think it was (only) that I was a spoiled nerd, because I saw exactly the same behavior in people who had never logged on using anything faster than their 33.6K analog modems. They didn’t have a faster reference point; they intuitively understood that the Web is only marginally useful at analog speeds. So they modified their behavior, to the detriment of their time online, using the Web just some, a little, from time to time, when they had to.

Then, a couple of months ago, I got hooked up to a cable modem line. And—as Michael almost said—it changed everything.

The world of fast Web access, a.k.a. broadband, is divided among cable access from cable TV providers, ADSL access from phone companies, and minidish satellite access from Hughes. I find satellite too limited and too expensive for most consumer use. It’s a metered service; it tops out at around 400 Kbps; and since it’s only a downlink, you still have to have an analog modem, phone line, and second ISP account to send your stuff up to the Web.

But both cable and ADSL connections rock. And this year we’re going to see an explosion in the number of PC users connected to the Web via one of these broadband channels. Right now there are about 500,000 U.S. cable modem users.

Cable access promises, in theory, connections of



Then, a couple of months ago, I got hooked up to a cable modem line. And it changed everything.

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up to 10 Mbps—but you won't see anything like that. Expect 700 Kbps to 800 Kbps, and on a slow night perhaps half that. Slow nights? In the cable modem world, you're sharing available bandwidth with some unknown number of your neighbors, who are all on one leg of the network. If lots of people log on, your typical speed may be cut in half.

You'll pay about \$40 per month for cable access, plus \$100 or so for the installation (which requires both a standard Ethernet NIC and a "cable modem," which isn't a modem at all, but don't tell your cable provider that). And you'll think this is a screaming bargain.

ADSL—for Asymmetric Digital Subscriber Line, because your downlink is many times as fast as your uplink, which is perfectly okay—is potentially even faster. In some places in the U.S. and Canada, you can actually get up to about 7 Mbps. But not in many places.

Because America's phone companies are engaging in a stupid cost-saving punt called G.lite. That's a speed-compromised version of ADSL that maxes out at 1.5 Mbps down to your PC. The phone companies have gotten behind G.lite mainly because it saves them a few bucks on a one-time visit to your home. That visit would allow them to install a splitter, essential to give you both data and voice access on a single ADSL line. Because G.lite doesn't require the splitter or the visit from the phone guy, the telco saves a few bucks. But it limits, on a continuing basis, your ADSL performance to much less than the 7 Mbps ADSL can deliver. Even worse, most telcos are also capping even their G.lite service. You can usually get up to 256 Kbps, maybe 384 Kbps, for about \$50 per month when you sign up with your friendly local phone company. To get anything like the full speed of even G.lite, you typically have to pay a premium of another \$150 a month or more—sometimes a *lot* more.

I like cable better, but if ADSL is your only choice, jump on it. You won't be sorry.

And watch for those symptoms of BCML Syndrome. Avoid contact with other PC users. Above all, be sensitive to any signs of NLFE, which can be *really* nasty. **PC**

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If you want to make movies—and you want to make them with your PC—it's going to cost you. Specifically, if you want to edit videos using the PC, set aside a bunch of evenings and weekends to learn and then to edit. Your colleagues will be impressed by the results. And by the amount of time you've spent.

Thanks to digital video (DV) camcorders and PCs with IEEE 1394 (FireWire) connections, you can now capture high-resolution video with your PC, edit it, add titles and transitions, and write it back out to DV or standard VHS videotape. All this is *nonlinear editing*, meaning you can jump to any point in the tape (because it's now stored on the hard disk).

For the past month, I've been working with a Sony VAIO Digital Studio, which is a Sony VAIO desktop PC with an IEEE 1394 connection (Sony calls it the i.Link), a big hard disk, and two bundled applications—Sony's own editing and capturing software, DVgate, and the more comprehensive Adobe Premiere LE. I've connected it to a palm-size Sony DV camcorder. Roughly speaking, DV quality is as far above that of Hi8 camcorders as Hi8 is above standard VHS. (See our next issue for a roundup of ten leading DV camcorders.)

Here's how it works: You shoot videos just as you always have. Then when you come back to the house or office, you can play back what you've shot on any TV with composite or S-Video connections or any PC with a 1394 connection—found on only a handful of systems from Compaq and Sony.

When you're ready to edit the tape, you transfer its contents to your PC via 1394 cable. The good news is that there's no additional compression or loss of quality as the data travels from camera to PC. The bad news is, the data pours onto the hard disk at about 3.6MB per second. Think about that: You could fill roughly one floppy disk for every half-second of footage, or one Zip disk every 30 seconds, or 14GB with the 60 minutes on a single DV cassette.

You can mark rough cuts as the PC captures the video and then fine-tune the exact transition points. One feature I missed was automatic scene detection, which is standard on tape-to-tape PC-based editors such as the Pinnacle Systems Studio 400 (www.pinnaclesys.com). This feature watches for a large number of changed pixels in adjacent frames, which indicates that a scene has changed—or that you're panning too fast. Using Premiere, you can add titles

and a potentially nauseating variety of transitions. You can also overlay background music. Then you write the results back out to DV tape or standard VHS; alternatively, you can save them for PC-based presentations as AVI or MPEG-1 files, trading off image quality for smaller disk requirements.

The results are great, but the time it takes to edit the tape is significant, even when you're past the learning curve. The nonlinear-editing nature of disk-based video saves time but not a lot. Figure at least 2 hours for each hour of tape for minimal editing, and as much as 10 hours if you have visions of grandeur. DVgate and Premiere are not tools for casual users; this is not Broderbund Print Shop for Video.

If the home/departmental video-editing market is to take off, there needs to be a far simpler, wizard-based video editor that lets you add titles, automatically tracks scene changes, lets you quickly delete unwanted scenes or goofs (the 30-second-long shot of the ground), and allows a couple of cute transition effects (but argues if you try for too much variety), then writes it all out to a second tape. Home editing will also be more attractive when standard hard disks are 100GB, not 10GB; when MPEG-2 encoders are standard on PCs (MPEG-2 is the encoding method used on DVDs), giving you high-quality storage with fewer space constraints; when every PC can create CDs—or better yet, DVDs that can be played on home DVD players; and when home AV devices have IEEE 1394 connections (coming within the year).

In the meantime, if you're in the market for a camcorder, give DV some consideration, instead of Hi8 or 8-mm. Prices range from just under \$1,000 to \$2,500, which is what a Hi8 camcorder cost just a few years ago. Look for a DV camcorder that has AV *inputs*, so you can convert your old 8-mm or VHS tapes to DV format for in-PC editing, using the DV camcorder as a pass-through device. Sony also has announced a sub-\$1,000 hybrid product, the Sony Digital 8 camcorder, which records a DV-style format on 8-mm tapes and has a 1394 connection; it also plays existing 8-mm tapes. **PC**



The results are great, but the time it takes to edit the tape is significant, even when you're past the learning curve.

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Microsoft Office Professional Upgrade: \$199
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Additional Li-Ion Battery: \$89

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Intel Celeron® Processor 366 MHz
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Compaq S700 17" Monitor (15.7" viewable)
40X Max CD-ROM
Compaq 56K V.90 PCI Modem
Creative Labs SBS50 Speakers
Matrix Millennium G200 AGP
Microsoft Windows 98
Microsoft Office 97 Small Business Edition
Free* Trial of Compaq Online Services
3-year Limited Warranty*

\$1,299*

Leasing Price: \$44/month*

Customize with these options:

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Iomega® Zip Drive: \$99



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Compaq 56K V.90 PCI Modem³
Creative Labs SBS50 Speakers
Matrox Millennium G200 AGP
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Microsoft Office 97 Small Business Edition
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3-year Limited Warranty⁴

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Leasing Price: \$59/month⁵

Customize with these options:

Upgrade to S900 19" Monitor (18" viewable) \$200
Upgrade to Atec Lansing ACS44 Speakers: \$50
DVD-ROM \$65

PROSIGNIA DESKTOP 330

Intel Pentium II Processor 450 MHz
25.5 GB Ultra ATA Hard Drive
128 MB (expandable to 256 MB)
Compaq S700 17" Monitor (15.7" viewable)
DVD-ROM G3
Compaq 56K V.90 PCI Modem³
Creative Labs SBS50 Speakers
Matrox Millennium G200 AGP
Microsoft Windows98
Microsoft Office 97 Small Business Edition
Free¹ Trial of Compaq Online Services
3-year Limited Warranty⁴

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Leasing Price: \$82/month⁵

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PENTIUM III HITS 500

PC Magazine Labs tests the first seven Pentium III PCs, which boast faster multimedia and enhanced 3-D performance.

When the sequel is successful, Part III is sure to follow. A year and a half after the debut of the Pentium II, Intel has introduced the Pentium III, a chip offering faster clock speeds than its predecessor as well as 70 new instructions that improve—in certain situations—the performance of such operations as Internet video compression and speech recognition, as well as 3-D geometry processing and 2-D image editing.

Initially available at 450 and 500 MHz, the Pentium III provides marginal improve-

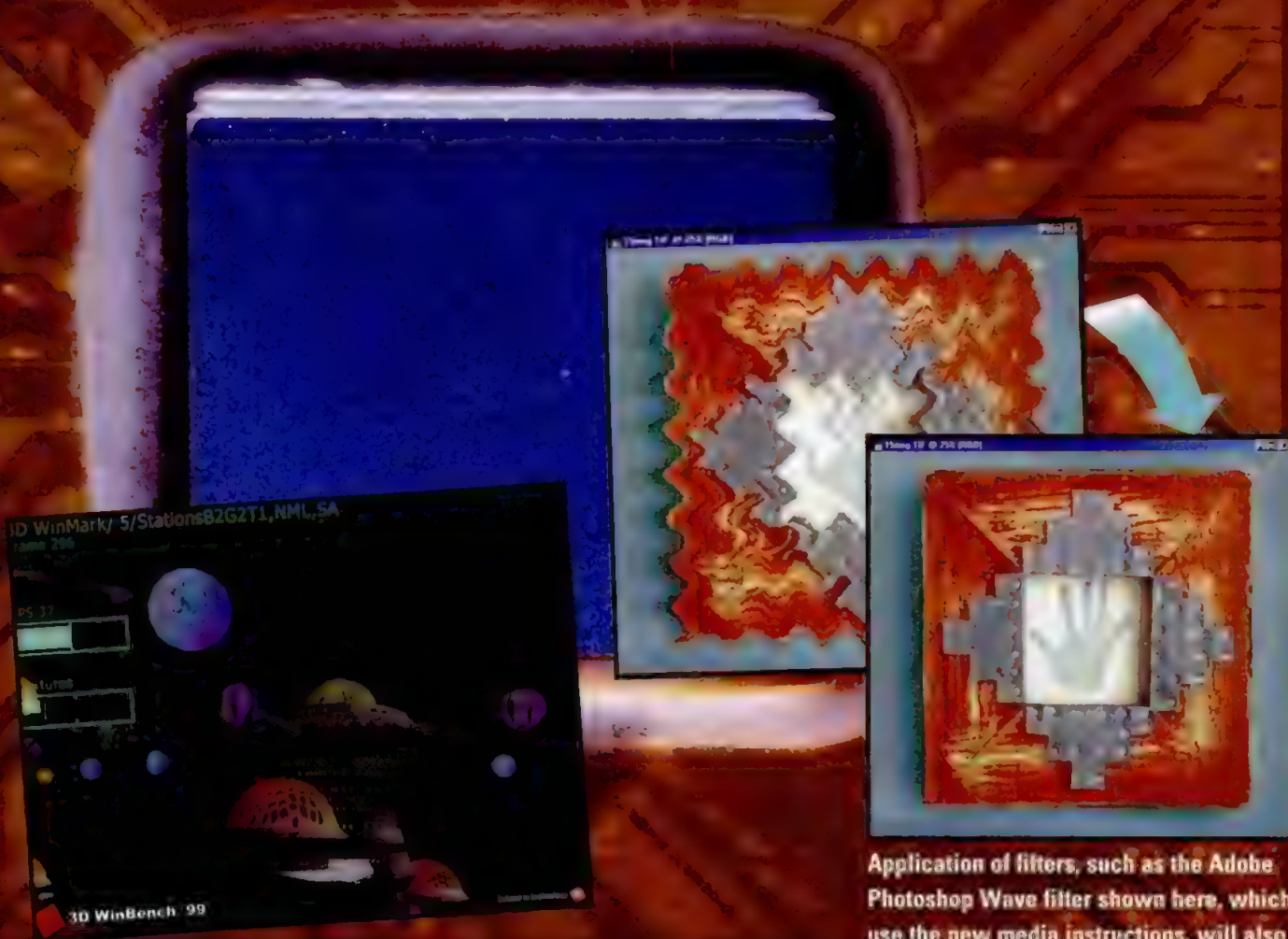
By Cade Metz

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■ 50 new SIMD floating-point instructions and 8 new dedicated floating-point registers can speed up the processing of floating-point calculations in scientific and engineering applications, among others.

■ 12 new media instructions for MMX integer functions can speed up MPEG-2 encoding as well as improve speech recognition.

■ A controversial new feature—the processor serial number—is meant to aid network and e-commerce security, but some fear it will lead to loss of privacy.



Specific 3-D functions, such as lighting and transformation calculations, used in 3-D graphics packages as well as 3-D games, will be faster.

Application of filters, such as the Adobe Photoshop Wave filter shown here, which use the new media instructions, will also speed up.

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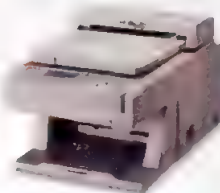
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Editors' Choice

• Compaq Desktop Prosignia 330



For \$2,990, the Editors' Choice—winning Compaq Desktop Prosignia 330 offers the best feature set in this roundup. Compaq sweetens the deal with additional

services that cater to the needs of small and medium-size businesses.

The Prosignia 330 begins with a Pentium III/500, a 19-inch monitor, an STB Velocity 440 graphics card with 16MB of RAM, and a 21.5GB hard disk, all of which add up to good performance across our tests—and especially on our 3-D tests. You also get top-notch multimedia, thanks to a Creative Labs DVD drive, a Creative Labs Sound Blaster Live! sound card, and Altec Lansing speakers. An Iomega Zip Drive rounds out the hardware offering. The entire package is housed in a well-designed case that affords easy access to all interior components and features swing-away drive bays to simplify servicing further.

The Internet wizard worked on the first try, and Compaq includes clear and ample documentation both with the unit and on its Web site. Compaq also offers a set of Online Services specially designed to meet the needs of small and medium-size businesses, such as secure, online data backup. Compaq earned four above-average scores and one average score on our latest Service and

Reliability Survey.

Two other systems impressed us and earn honorable mention: the Dell Dimension XPS T500 (\$2,657 direct) and the Micron Millennia MAX 500 (\$2,899 direct). Both offer a strong hardware package—and excellent multimedia features in the Micron's case—with solid performance and a good warranty. New users or those wishing to learn new skills will find Micron's offer very attractive for one year of free courses through its online Micron University. The Dell unit had a smaller monitor than the others (17-inch) but is a good value, and Dell's Web site is well organized and full of system-specific information. Dell also earned top scores across the board on our Service and Reliability Survey. Like Compaq, Micron had four above-average scores and one average score on our Service and Reliability Survey.

The Gateway G6-500 (\$2,974 direct) also has a lot of good hardware and did well on most of our tests, but the unit we received had problems with its BIOS, which affected Internet setup as well as Windows Explorer.

ments under existing software, but it's still worth the while of the PC enthusiast. Pentium III systems are priced only slightly higher than Pentium II/450 PCs, often no more than \$200 more, so there's little reason to look elsewhere if you're shopping at the top of the market. And if you're a DVD enthusiast, you'll be glad to know that the chip can bring software playback to the same level as hardware playback for most common viewing—really.

Yet the chip could soon face competition from two AMD CPUs equipped with AMD's 3DNow! technology, a set of multimedia-centric instructions that has a slight head start on the Pentium III's set, known

as *Streaming SIMD (Single instruction, multiple data) Extensions (SSE)*. The Pentium III has also been the source of controversy recently, being the first Intel chip to use a new digital ID that many see as an infringement on the privacy of PC owners.

SEVEN NEW PENTIUM III MACHINES

Here, in addition to examining the new chip and its market, we review seven of the first Pentium III PCs from seven major vendors: Compaq, CompUSA, Dell, Gateway, Micron, NEC, and Quantex. Similar systems will soon be available from such manufacturers as Acer, HP, and IBM.

We required the systems to have a 500-

MHz Pentium III and 128MB of RAM; by default, all currently use the Intel 440BX chip set. All vendors chose to use the nVidia RIVA TNT graphics engine, and there were slight variations in disk, audio systems, and DVD engines, but these PCs are physically very similar. Their prices vary from roughly \$2,550 to \$3,400; but the principal differences involve how easily they can be set up, operated, attached to the Internet, and repaired.

Thus in rating these systems, we've tested them not only with our benchmark tests but also with PC Magazine Labs' ease-of-use script, which asks nearly 200 questions about a machine's design, help tools, Internet software, documentation, and service options. And to round out our testing, we examined each vendor's Web site, determining where it was easiest to purchase and service systems online (for more details, see the sidebar "Vendor Web Sites: The Best and the Rest").

All considered, the Compaq Desktop Prosignia 330 is our Editors' Choice. Providing a brilliantly designed chassis, helpful documentation, and several Internet-based productivity tools, Compaq edged out Dell—whose system cost slightly less but didn't perform as well under the subcategories of our ease-of-use script—and Micron, whose PC had strong marks for multimedia but also faltered on ease of use.

THE PENTIUM III AND SSE

While in development, the Pentium III was known as Katmai. When Intel released the chip's official name in January of this year, many found the moniker misleading. The new chip uses the same 100-MHz bus as the latest Pentium IIs, the same 512K half-speed L2 cache, and the same basic Slot 1 casing. If not for the increase to 500 MHz (a 50-MHz boost over the Pentium II), the Pentium III would offer only one new performance-enhancing feature: Intel's SSE.

The SSE architecture certainly makes the chip an improvement over the Pentium II, but it takes effect only when you're using SSE-specific software code, typically involving graphics, audio, or video. SSE is essentially a more advanced version of MMX, a set of multimedia-centric extensions that debuted on the Pentium MMX in January of 1997 and is still being used by the Pentium III. The basic difference is that while MMX deals with integer calcu-

PRICE/PERFORMANCE INDEX: PENTIUM III PCs

Because of similar hardware (identical CPUs and graphics chip sets, for example), the seven systems in this roundup are clustered together on our Price/Performance Index. The \$2,657 Dell Dimension XPS T500 stands out as a top value, offering a good blend of hardware, performance, and price. The Dell unit comes with a 19.5GB Maxtor hard disk, a 17-inch monitor, a DVD drive, and a 100MB Iomega Zip Drive. It has top ratings on our Service and Reliability Survey and features top-notch DVD playback as well. Dell's Web site is particularly good, especially in support for your purchased system.

Our Editors' Choice—winning Compaq Desktop Prosignia 330 builds on the same foundation as the Dell unit. It has equally good DVD playback but comes with a 21.5GB IBM disk, a 19-inch monitor, and one of the best sound systems in this roundup, using the Creative Labs Sound Blaster Live! card and Altec Lansing speakers with sub-woofer. The \$2,990 unit also has a well-designed, easy-to-service case, and Compaq offers a number of programs and services designed specifically for small businesses. Compaq's Web site is good as well.

The top performance/features score goes to the \$2,974 Gateway G6-500. Although it has a slightly smaller hard disk than some others here (16.7GB), it comes with a Phillips CD-R drive as

well as a DVD drive, a 19-inch monitor, and top-performing sound components. The unit also had the roundup's best overall *ease of use* rating.

THE DATA POINTS

Results on our Business Winstone 99 and 3D WinMark 99 tests account for 25 percent of the performance/features score. *Ease of use*, *Internet*

purchase, and *Internet support* ratings account for 13 percent of the score. Features such as toolless drives and chassis and available bays and slots make up 8 percent. Warranty and service policies make up another 10 percent. Other features, such as DVD drive and speed, MPEG-2 support, network cards, sound cards, and USB support make up the remainder of the score.

PERFORMANCE/ FEATURES



lations, SSE can enhance floating-point calculations, which play a large part in 3-D geometry processing and other high-end multimedia operations (for more on SSE, see the sidebar "Extending Pentium III").

Thus when running our Business Winstone 99 tests, comprising several business applications, the Pentium III performed only slightly better than the Pentium II. We tested the Dell Dimension XPS T500 on Winstone not only with its native 500-MHz Pentium III but also with a 450-MHz Pentium III and 450-MHz Pentium II. Equipped with the Pentium III/500, it scored only 7 percent higher than with the Pentium II—less than the 11 percent clock speed increase alone would indicate. With the Pentium III/450, the PC scored less than 1 percent higher than the Pentium II.

To see more benefit from the Pentium III, you first need an operating system that recognizes SSE. Currently only Windows 98 natively supports the extensions, but

Microsoft also provides support under Windows NT 4.0 via Service Pack 4+. Support is forthcoming from updates to Linux 2.3, NetWare 5, Solaris 7, and UnixWare 7 as well as from Windows 2000. Yet OS support alone won't get you very far. To see substantial improvements, you need one of three additional items: an application coded for SSE, a graphics driver coded for SSE, or a 3-D application that uses the Microsoft DirectX 6.1 API, which uses SSE in its lighting and transformation 3-D code.

Thanks to the SSE enhancements under DirectX 6.1, the Pentium III is more adept on a specific section of our 3D WinBench 99 tests as well as on 3D WinMark 99 itself. Tested in the Dell PC, the Pentium III/450 scored 7 percent higher than the Pentium II/450 on 3D WinMark and 79 percent higher on the lighting and transformation portion of 3D WinBench.

We also compared the performance of each chip under early versions of two

applications (not yet shipping) specifically coded for SSE: Adobe Photoshop 5.0.2 and Microsoft NetShow. Timings for video encoding under NetShow improved only 8 percent from the Pentium II/450 to the Pentium III/450, but with some Photoshop filters, they improved by up to 43 percent.

The question is: When will SSE-specific applications be available to end users? None of the Pentium III machines reviewed here will initially ship with SSE software, and no SSE software was available for purchase as we completed testing. At the debut of MMX, at least a few applications using the new extensions were already on the market.

Eventually, however, SSE should be far more successful than MMX, which is used in few major applications even now. By the time you read this, Intel will have held an event where hundreds of independent software vendors plan to demonstrate their SSE-enhanced software. By year end, everything from Web development tools to digital content-creation software to 3-D games to e-commerce should use SSE. SSE drivers from graphics card vendors will also soon arrive.

Our Contributors: CADE METZ is a senior writer at *PC Magazine*. NICK STAM is a technical director at PC Magazine Labs. MARY E. BEHR is a staff editor at *PC Magazine*. RICH FISCO was the senior project leader, and ANUSH YEGYAZARIAN was the associate editor in charge of this story.

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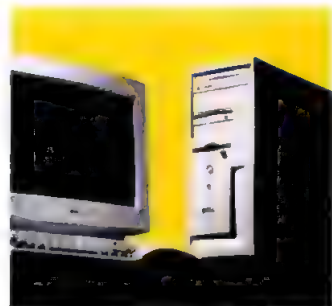
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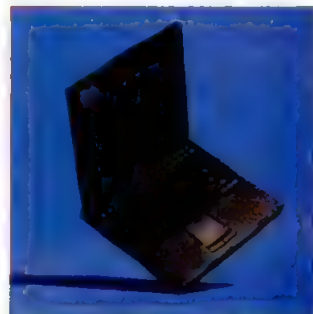
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- 3-Year Limited Warranty[†]

\$3399

Business Lease[®]: \$129/Mo., 36 Mos.

 **E-VALUE CODE: 04054-890233**

NEW DELL INSPIRON 7000 A333LT PENTIUM II PROCESSOR AT 333MHz

All-in-One Multimedia Performance

- 15" XGA Active Matrix Display
- 64MB SDRAM (384MB Max[®])
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max[™] Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- 3D Surround Sound
- 12-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]
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- ★ 3Com[®] Fast Ethernet Adapter, add \$129.

\$2799

Business Lease[®]: \$106/Mo., 36 Mos.

 **E-VALUE CODE: 04054-890227**

NEW DELL INSPIRON 7000 A333GT PENTIUM II PROCESSOR AT 333MHz

All-in-One Multimedia Performance

- 14.1" XGA Active Matrix Display
- 64MB SDRAM (384MB Max[®])
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max[™] Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- 3D Surround Sound
- 12-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]
- ★ Upgrade to 96MB SDRAM, add \$99.
- ★ Custom Leather Case, add \$99.
- ★ Internal 56K Capable[™] V.90 Modem, add \$59.

\$2599

Business Lease[®]: \$98/Mo., 36 Mos.

 **E-VALUE CODE: 04054-890225**

NEW DELL INSPIRON 3500 A300GT PENTIUM II PROCESSOR AT 300PE MHz

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- Modular 24X Max[™] Variable CD-ROM
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound
- 9-Cell Intelligent Lithium Ion Battery
- APC SurgeArrest PNote 1 Pro
- Internal 56K Capable[™] V.90 Modem
- Trial Offer ConnectDirect Internet Access[†]
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]

\$2299

Business Lease[®]: \$87/Mo., 36 Mos.

 **E-VALUE CODE: 04054-890222**

DELL INSPIRON 3500 D266XT PENTIUM II PROCESSOR AT 266MHz

Light Weight, Light Price

- 13.3" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- Modular 24X Max[™] Variable CD-ROM
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound
- 9-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty[†]

\$1999

Business Lease[®]: \$76/Mo., 36 Mos.

 **E-VALUE CODE: 04054-890219**

DELL LATITUDE CPi D300XT PENTIUM II PROCESSOR AT 300MHz

Network-Optimized Notebook

- 13.3" XGA Active Matrix Display
- 64MB EDO RAM (256MB Max)
- 4.3GB Ultra ATA Hard Drive
- Modular 24X Max[™] Variable CD-ROM
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound
- Intelligent Lithium Ion Battery
- MS Windows NT[®] Workstation 4.0
- Touchpad
- 3-Year Limited Warranty[†]
- 1-Year NBD On-site[®] Service

\$2899

Business Lease[®]: \$110/Mo., 36 Mos.

 **E-VALUE CODE: 04054-790228**

DELL LATITUDE CPi D233ST PENTIUM II PROCESSOR AT 233MHz

Network-Optimized Notebook

- 12.1" SVGA Active Matrix Display
- 64MB EDO RAM (256MB Max)
- 4.3GB Ultra ATA Hard Drive
- Modular 24X Max[™] Variable CD-ROM
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound
- Intelligent Lithium Ion Battery
- MS Windows NT Workstation 4.0
- Touchpad
- 3-Year Limited Warranty[†]
- 1-Year NBD On-site[®] Service

\$2399

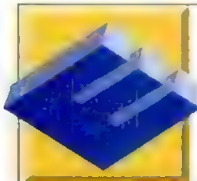
Business Lease[®]: \$91/Mo., 36 Mos.

 **E-VALUE CODE: 04054-790223**

DELL NOTEBOOK AWARD INFO

- Two-time "A" rating in *PC Magazine Readers' Choice Awards for Service and Reliability*, 7/98; 7/97.
- Latitude Line – *PC Computing's* "Best Overall" Rating Three Years (1996-1998).
- Inspiron 7000 D300GT – *CNET Editors' Choice*, "Leading Edge Notebooks," 9/98.

Advertised configurations vary from award-winning configurations.



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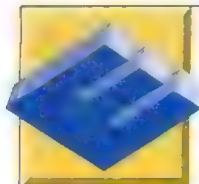


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DELL® POWEREDGE® 6300 SERVER PENTIUM® II XEON™ PROCESSOR AT 450MHz (QUAD PROCESSOR CAPABLE)

- 128MB ECC EDO Memory
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- Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives
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- 7 Expansion Slots: 4x64-bit, 3x32-bit PCI
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\$11,749

Business Lease[®]: \$416/Mo., 36 Mos.

 **E-VALUE CODE: 04055-290203**

DELL POWEREDGE 4300 SERVER PENTIUM II PROCESSOR AT 450MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 18GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max[®] Variable SCSI CD-ROM
- HP OpenView NNM Special Edition
- Intel® Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Pluggable Power Supplies, Cooling Fans and Processor Fans
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1.6" Hard Drive Bays
- 4 External 5.25" Drive Bays
- 3-Year NBD On-site[®] Service
- 1-Year DirectLine NOS Support
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$5899

Business Lease[®]: \$217/Mo., 36 Mos.

 **E-VALUE CODE: 04055-290258**

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 450MHz (RAID 5 CONFIGURATION)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- Three 9GB Ultra-2/LVD SCSI Hot Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC
- 32X Max[®] Variable SCSI CD-ROM
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Floppy
- 3-Year NBD On-site[®] Service
- 7x24 Dedicated Server Hardware Telephone Technical Support

\$5249

Business Lease[®]: \$193/Mo., 36 Mos.

 **E-VALUE CODE: 04055-290252**

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With one phone call to Dell, you can now customize your small business network with the right systems and peripherals – and have them installed for you! Some of the services we offer include:

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Must purchase a PowerEdge server to be eligible for installations services.

DELL SERVER AWARD INFO

- *Network World* "World Class Award" for flexibility, serviceability and manageability – Dell PowerEdge 2300, 6/98.
- *Computer Shopper* "Top 100" – Dell PowerEdge 2300, 11/98.
- *PC Computing's* "The 'A' List" – Dell PowerEdge 6300, 11/98.
- *Fortune* – 1998 Readers' Choice Award for Personal Service and Reliability, 11/98.
- *LANTIMES* "The Best of LANTIMES Over \$25,000" – Dell PowerEdge 6300, 9/98.
- *ComputerWorld's* "Leaders' Choice" Winner Workgroup Servers – Dell PowerEdge Family, 1/98.

Advertised configurations vary from award-winning configurations

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 9GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max[®] Variable SCSI CD-ROM
- MS® Windows NT® Server 4.0
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
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- ★ Upgrade to a Pentium II Processor at 450MHz, add \$300.

\$3849

Business Lease[®]: \$146/Mo., 36 Mos.

 **E-VALUE CODE: 04055-290238**

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 350MHz (DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 4GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max[®] Variable SCSI CD-ROM
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Floppy
- 3-Year NBD On-site[®] Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ Upgrade to a Pentium II Processor at 400MHz, add \$300.

\$2349

Business Lease[®]: \$89/Mo., 36 Mos.

 **E-VALUE CODE: 04055-290223**

NEW DELL POWEREDGE 1300 SERVER PENTIUM II PROCESSOR AT 350MHz (DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 4GB Ultra-2/LVD SCSI Hard Drive
- 32X Max[®] Variable EIDE CD-ROM
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated PCI Ultra-2/LVD SCSI Controller
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1"
- 3 External 5.25" Drive Bays
- 3-Year NBD On-site[®] Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ Add a Pentium II Processor at 350MHz, \$399.

\$1849

Business Lease[®]: \$70/Mo., 36 Mos.

 **E-VALUE CODE: 04055-290218**

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DELL PRECISION™ WORKSTATION 610 PENTIUM® II XEON™ PROCESSOR AT 450MHz (Dual Processor/RAID Capable)

- 256MB 100MHz ECC SDRAM
- 512KB Full-Speed Integrated L2 Cache
- 9GB Ultra-2/LVD SCSI Hard Drive
- Adaptec RAIDPort Ultra-2/LVD Adapter
- 21" (19.8" vis) Trinitron® 1600HS Monitor
- 3Dlabs Oxygen GMX 2000 Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- Integrated 3Com® 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS® Windows NT® 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site* Service
- 7x24 Dedicated Hardware Tech Support
- ★ Upgrade to a NEW 17" Flat Panel 1700FP Display, add \$1000.

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Business Lease*: \$237/Mo., 36 Mos.

E-VALUE CODE: 04056-490264

DELL PRECISION WORKSTATION 410 PENTIUM II PROCESSOR AT 400MHz (Dual Processor/RAID Capable)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 Cache
- 4GB Ultra-2/LVD SCSI Hard Drive
- 17" (15.9" vis) M780 Monitor
- Diamond 8MB AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- harman/kardon HK-195 Speakers
- Integrated 3Com 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS Windows NT 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site* Service
- 7x24 Dedicated Hardware Tech Support

\$2859

Business Lease*: \$108/Mo., 36 Mos.

E-VALUE CODE: 04056-490228



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THE INTERNET.

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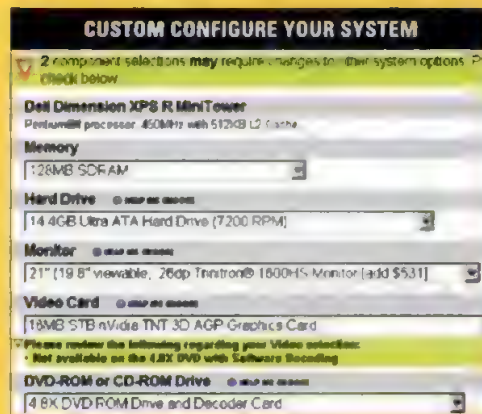
- \$2199**

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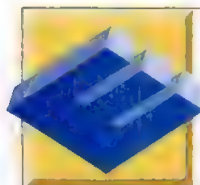
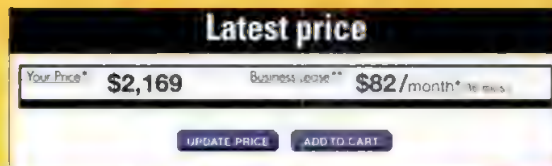
 GO TO THIS



3 ENTER THIS

 BUILD THIS

5 AND GET THIS



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PRODUCTS ENTER THE FLOW OF THE NEW AT
WWW.VERBODEN.NL TO GET THE LATEST
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SCORECARD

500-MHz PENTIUM III PCs



Three units—the Compaq PC (our Editors' Choice) and the Dell and Gateway systems—received the best *ease of use* rating in this roundup: a *fair*. Though each company has made some strides toward easing the way for users, there is still a long way to go. Gateway's HelpSpot—a well-organized CD of troubleshooting, installation, and upgrading tips—was very good, but we encountered BIOS-related problems with its Windows Explorer and Internet connectivity. The printed documentation we received from Compaq and Dell was more complete than Gateway's but neither company sent electronic documentation with their systems initially (such documentation is typically offered).

Most systems provide some guidance for **connecting to the Internet**. Some vendors, such as CompUSA and Gateway, lacked free connection time, and all others except Quantex lacked a quick start guide to help. Most had Internet wizards, however, and with the Compaq unit, everything worked on the first try. Most vendors lacked programmable keyboards or external controls for CD or audio functions, leading to *poor* ratings on **common tasks**. The Gateway had a programmable keyboard, but it faltered because of its BIOS problem. The Compaq machine pulled ahead of the others in **troubleshooting and support**, thanks to a thorough troubleshooting guide, good expansion potential, and remote diagnostic capability.

The Compaq, Dell, and Gateway units each received two *excellent* ratings, for **Internet support** and **multimedia**. The three vendors offer fairly well-organized sites with plentiful driver updates and bug fixes.

In the **Internet purchase** category, the Compaq, Dell, and Micron PCs were the highest scorers, rating *good*. Each of these three companies made the entire ordering process

quick and painless, offering well-organized help.

Keep in mind when considering our scorecard that we are rating the machines as we received them for this roundup. Although we do know that some of the problems we see with these early production models may be corrected by the time you purchase one, the only way to be fair is to evaluate what we see, not what may be included with systems shipping later. Also, scores are not adjusted to provide an *excellent* and *poor* in every category.

HOW WE RATED

The **Internet purchase** rating depends, in part, on the quality of the vendor's PC configurator, and the ease of navigating its Web site. The **Internet support** rating takes into account the presence of driver updates and bug fixes on the vendor's Web site, as well as other tips and tricks for smooth computer operation, and more. We also look for system-specific documentation. For our **multimedia** rating, we examine the sound cards, speakers, and DVD features and playback, as well as 3-D performance, among other items.

Our **ease of use** rating is based on nearly 200 questions, organized into four breakout categories. **Setup and getting started** makes up 30 percent of the rating and covers print and disk documentation as well as setup guides and labeled ports. **Connecting to the Internet** is another 20 percent; we look for pre-loaded ISPs, free time included, and problem-free operation on the first try. The **common tasks** category makes up 20 percent; we look for one-touch launch application buttons and at DVD implementations. **Troubleshooting and support** is worth 30 percent. Important points include coherent guides to troubleshooting, and comprehensive service and support, remote diagnostic capability, and information provided on the Web site.

	INTERNET PURCHASE	INTERNET SUPPORT	MULTIMEDIA	EASE OF USE	Setup and getting started	Connecting to the Internet	Common tasks	Troubleshooting and support
Compaq ProSignia 330	Good	Excellent	Excellent	Fair	Poor	Fair	Poor	Good
CompUSA PC American Pro 500	Fair	Poor	Fair	Poor	Poor	Poor	Poor	Poor
Dell Dimension XPS T500	Good	Excellent	Excellent	Fair	Poor	Fair	Poor	Fair
Gateway G6-500	Fair	Excellent	Excellent	Fair	Fair	Fair	Poor	Fair
Micron Millennia MAX 500	Good	Fair	Excellent	Poor	Poor	Fair	Poor	Fair
NEC PowerMate 8100	Fair	Fair	Good	Poor	Poor	Fair	Poor	Fair
Quantex QP6/500 SM-4x SE	Fair	Fair	Good	Poor	Poor	Poor	Poor	Poor

THE PROCESSOR NUMBER

Other than SSE, the only significant architectural difference between the Pentium II and the Pentium III is the latter's use of Intel's new *processor serial number*. Each Pentium III will contain a unique digital ID that, if turned on, can be read over a network. This is meant to be a security feature, a means of controlling e-commerce, software licenses, and access to corporate networks.

Network security is certainly worth improving, but some see the processor serial number as a violation of privacy. When Intel announced the feature, several civil

liberties groups called for a boycott of the Pentium III, fearing that marketers would soon be tracking user activities over the Internet. In response, Intel has made a slight change to the feature, turning the processor serial number off by default but giving users the ability to turn it on. The first production runs of the Pentium III may have the number turned on by default, and software—which will be provided—will be needed to disable it each time you boot.

COMPETITION FROM AMD

Very soon Intel may be less concerned with civil liberties groups than with AMD,

which should announce two new CPUs by midyear. By the end of the first quarter, AMD will introduce the K6-3, a version of the K6-2 that could (according to independent testers in possession of a prototype) outperform the Pentium II/450. Like the K6-2, the 400- to 450-MHz K6-3 uses a 100-MHz bus and contains 64K of primary cache. Unlike the K6-2, it also includes 256K of on-board, full-speed secondary cache (L2) and typically connects to 512K of off-board tertiary (L3) cache. The Pentium III has no L3 cache, and its 512K L2 cache runs at half speed.

Before midyear AMD should follow the

VENDOR SERVICE AND RELIABILITY

We rate vendors for which we received at least 50 responses in our latest Service and Reliability Survey of 17,000 subscribers. We analyze the data using a *t*-test, a standard statistical procedure for identifying differences that are significant at a 95 percent confidence level. For details on our testing methodology as well as information on other desktop and notebook vendors, see page 219 of our July 1998 issue or point your browser to www.zdnet.com/pcmag/special/reliability98/index.html. The satisfaction rankings reflect respondents' experiences with reliability, repair, and tech support over the past two years. **Units needing repair** refers to the proportion of the desktops that the respondents said needed repair during the past year. In this category, "significantly better than average" means the incidence of needed repairs was lower than average. **Buy again?** reflects the proportion of respondents who would buy a new PC from the same vendor.

▲ Significantly better than average ○ Average ● Significantly worse than average

	Satisfaction with			Units needing repair over the past 12 months	Buy again?
	Reliability	Repair	Tech support		
Compaq	▲	○	▲	▲	▲
Dell	▲	○	▲	▲	▲
Gateway	▲	▲	○	○	▲
Micron	▲	▲	▲	○	▲
NEC	○	○	○	○	▲
Quantex	▲	▲	▲	○	▲

K6-3 with the K7—an even faster chip that finally eschews AMD's Pentium-like physical design in favor of a design similar to that of the Pentium III. Meant for high-end PCs, workstations, and servers, this chip will likely debut at 500 MHz, use a 200-MHz bus (derived from the Compaq Alpha 21264 chip), and be placed—along with 128K of half-speed L2 cache—on an enclosed circuit board. This CPU will plug into Slot A, an interface supported by upcoming chip sets from ALi, AMD, and Via.

Each new chip will use AMD's 3DNow! technology, a set of multimedia extensions comparable to SSE in some respects, but lacking SSE's cache bypass and memory streaming capabilities. Having debuted with the K6-2, 3DNow! is already being used by a host of 3-D games as well as by the DirectX API and IBM's ViaVoice. We will test 3DNow! and SSE as more applications are coded for both technologies.

SUCCESSORS TO THE PENTIUM III

Of course, Intel won't be sitting idle while AMD churns out processors. Just after the arrival of the Pentium III, the company will introduce Tanner, which is basically a 500-MHz Xeon workstation and server chip

with SSE. Though it doesn't seem likely that SSE would play a big role with servers, Intel claims that performance of some TCP/IP functions will be better under SSE-friendly operating systems and that database vendors will begin using SSE as well.

SSE will likely play a greater role with Coppermine, the first Intel chip built on a 0.18μ manufacturing process. Due in the second half of 1999, Coppermine will likely debut at 600 MHz and use a 133-MHz system bus. Subsequently the 0.18μ process will reach Intel's workstation and server line with a chip code-named Cascades.

INTEL'S LINE TODAY

At the moment Intel's mainstream CPUs are led by the Pentium III. Until the SSE application market matures, the seven Pentium III PCs reviewed here won't be that different from their Pentium II predecessors. Each offers good DVD playback, a three-speaker audio subsystem, a tool-free chassis, and a built-in mass storage drive as well as some of the best performance on the mainstream market, however. And with the exception of Compaq's system, which uses a flat-panel display, each sells for less than \$3,000.

Compaq Desktop Prosignia 330

21.5GB disk, 19" monitor. Business Winstone 99: 24.5. \$2,990 direct. Warranty: 3 years parts, 1 year labor, 1 year on-site service. Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; www.compaq.com.



With the Prosignia 330—a small-business PC sold not only through resellers but also over the Web and via telephone—Compaq has, in many ways, beaten the traditional direct vendors at their own game. The Prosignia 330's (our Editors' Choice winner) basic hardware is no more impressive than that of the Gateway or Micron, but it is only marginally more expensive than the Dell and Quantex Pentium III PCs and it's the most compelling PC here. The system offers a uniquely tractable chassis, extensive help documentation and software, easy access to the Web, and a generous support policy. Compaq also offers a number of services geared toward small and medium-size businesses to improve productivity and help with setup and maintenance of e-commerce.

Like many Compaq PCs, the Prosignia 330 can be used as either a horizontal desktop system or a vertical mid-tower. The

PC EDITORS' HOT LINKS

www.pcmag.com/hotlinks

Please join us online for an interactive look at this story as well as detailed information about our benchmark tests. This page also includes links to additional Pentium III reviews, news, and commentary on our parent site, ZDnet.

► AMD K6-2 Processor with 3DNow! Web site

www.amd.com/products/cpg/k623d/index.html

Discusses the Super 7 architecture, lists games optimized for 3DNow!, and tells where to buy AMD K6-2 with 3DNow! products.

► CPU Info Center

infopad.eecs.berkeley.edu/CIG/
Includes product announcements, links to online resources, and a bibliography of books and articles.

► Intel Pentium III Web site

www.intel.com/design/PentiumIII/
Gives technical information, and a list of software that takes advantage of Pentium III with SSE.

► Intel White Paper on Streaming SIMD Extensions (SSE)

<http://developer.intel.com/drg/news/katmai.htm>
White paper from Intel that out-

lines the software benefits of SSE. For more general developer information, go to <http://developer.intel.com>.

► MicroDesign Resources

www.chipanalyst.com
In-depth analysis of microprocessor technology by staff of *Microprocessor Report*.

► Yahoo Semiconductor Industry News

biz.yahoo.com/news/semiconductor.html
Stories from Business Wire, PR Newswire, and Standard & Poor's.

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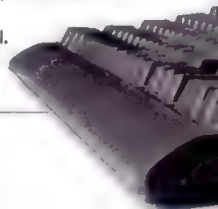
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*Bandwidth based on graphics to main memory. †Requires additional software under Windows NT Workstation 4.0. **I/O bandwidth as compared to 32-bit PCI. ‡For information on the 1999 availability of the Silicon Graphics 540 workstation, please call 1-888-SCG-4289. Prices quoted are for U.S. only.
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BENCHMARK TESTS

500-MHz PENTIUM III PCs



You won't get much out of the new Pentium III if most of your work involves business applications, but as expected, you will see improvements in 3-D applications. Make sure you have the latest graphics drivers for top performance.

The **ZD Business Winstone 99** test program measures overall system performance with standard business productivity applications. Since the seven systems we tested were similarly outfitted, we saw only about a 5 percent difference between the best and worst scores. You'll notice that the Pentium III's Streaming SIMD Extensions (SSE) have no real impact on typical business applications: The Pentium II/450 and Pentium III/450 comparison systems virtually tied on this measure.

For the first time in a roundup, we saw Ultra ATA-66 hard disks. These drives have twice the burst-mode data-transfer rate of Ultra ATA-33 drives. Ultra ATA-33 drives transfer data at a peak rate of 33.3 MBps, while Ultra ATA-66 models double that to 66.6 MBps. Of the four systems that offered Ultra ATA-66 drives—units from Compaq, Gateway, Micron, and Quantex—only the Gateway PC paired it with a controller that can take advantage of it. The IDE controller embedded in the Intel 440BX chip set can handle only Ultra ATA-33. Gateway used a separate controller card from Promise Technology that supports Ultra ATA-66. We saw minimal performance benefits for typical business applications, but you can expect more if you're working with disk-intensive programs.

The **ZD 3D WinBench 99** test program measures graphics cards' 3-D capabilities. All the systems used nVidia TNT-based graphics cards, so we expected performance to be equal, but individual drivers played a big role. Two vendors, CompUSA and Quantex, were unable to get us updated drivers, a deficiency reflected in their units' 3-D performance. Their 3D WinMark scores were more than 30 percent lower than the average of the other systems in this roundup. The new driver (code-named Detonator by nVidia) delivers better performance because it properly enables the dual-pixel processing capability of the TNT chip set, which

wasn't enabled in previous drivers, and improves texture transfer speed and texture caching efficiency.

The 3D WinMark scores also show some performance gains thanks to SSE and the DirectX 6.1 API. We saw scores improve by 7 percent when using a 450-MHz Pentium III instead of the 450-MHz Pentium II processor.

We also ran 3D WinBench 99's Lighting and Transformation test. This test runs only the transform and lighting calculations—with no rendering—and is heavily floating-point-intensive. SSE floating-point code is implemented in DirectX 6.1, and 3D WinBench uses DirectX transform and lighting engines, leading to a sizable gain in these areas. We saw nearly an 80 percent increase on this test with the same speed Pentium III versus Pentium II. Going from a 450-MHz Pentium III to a 500-MHz model (the configuration used in the roundup's review units), we saw about a 10 percent performance boost. These gains correlate with CPUmark 99 results, as you would expect.

The **ZD Graphics WinMark 99** score reflects 2-D graphics capabilities. Unlike with 3D WinMark, the performance differences here were minimal. Because all systems used graphics cards based on the nVidia RIVA TNT chip set, the best and worst scores varied by only about 6 percent. Again, this difference was due to variations in graphics drivers.

Our new **CPUmark 99** test measures the performance of the CPU, caches, and main memory. With the identical processor, memory, and chip set in every system, the scores varied by only 3 percent from best to worst. As mentioned above, our comparison tests show you get a 10 percent increase with a Pentium III/500 PC over a Pentium III/450.

To show the effects of SSE in real applications, we used

▼ **Most scores were very close** because these seven systems were configured very similarly. All systems used nVidia RIVA TNT-based graphics cards, and only in places where different graphics drivers were involved did we see differences. The most dramatic differences were on the 3D WinMark 99 tests. The CompUSA and Quantex systems earned low scores because they

used older drivers; a simple driver upgrade should bring the scores in line with the others. The Quantex system, however, had double the score of the others on the Maximum Frame Rate portion of the Full-Screen Scaling test. Apparently its driver is optimized to allow hardware acceleration of video scaling while the other drivers are not.

BENCHMARK TESTS

▲ High scores are best.

▼ Low scores are best.

Bold type denotes first place.

■ denotes Editors' Choice

	ZD Business Winstone 99	ZD 3D WinMark 99	ZD 3D WinBench 99: Lighting and Transformation	ZD Business Graphics WinMark 99 ▲	ZD CPUmark 99 ▲	Full Screen Scaling* CPU Utilization (percent) ▼	Maximum Frame Rate (frames/sec) ▲
Compaq Desktop Prosignia 330	24.5	755	63.7	177	38.1	49	74.3
CompUSA PC American Pro 500	24.2	500	64.4	180	39.0	22	74.6
Dell Dimension XPS T500	24.5	787	63.2	176	38.7	48	74.5
Gateway G6-500	25.5	790	64.0	177	38.7	47	74.5
Micron Millennia MAX 500	24.9	784	64.0	181	38.5	49	73.9
NEC PowerMate 8100	24.4	690	62.4	179	37.8	57	74.2
Quantex QP6/500 SM-4x SE	24.8	487	63.3	170	38.1	24	150.0

* With an Action, MPEG-1 352-by-240, 30-fps, 300-Kbps clip

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James Senecal, LAN Specialist, Pacific Life Insurance, Newport Beach, CA.



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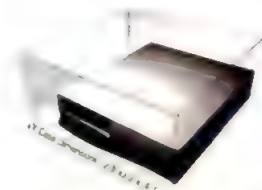
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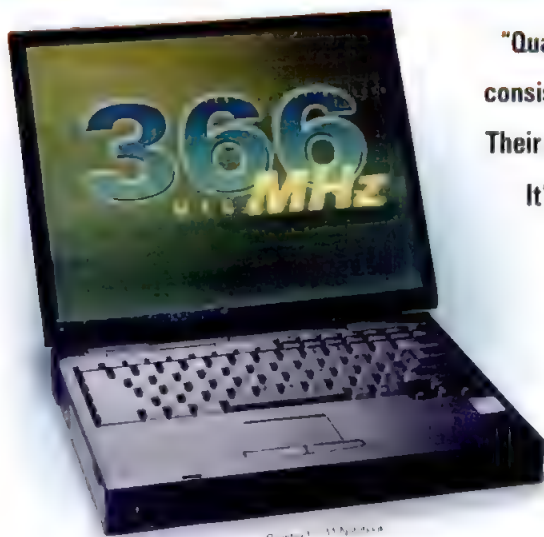
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- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
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QP6/350 M-3x(w/Pentium II processor 350MHz)...\$1449

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- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
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- MS Windows 98 / Value Multimedia Software Bundle
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BENCHMARK TESTS

Adobe Photoshop 5.0.2 with a prerelease version of its SSE plug-in. We ran five filters that showed varying degrees of improvement due to SSE. The filters that showed the biggest gains, such as Wave and Twirl, are likely to rely more heavily on the new instructions included in SSE code. We noticed the biggest performance boost on our Wave filter test where the timing improved by over 40 percent. The second-largest improvement came in the Twirl filter, where the Pentium III/450 shaved one-third off the Pentium II's timing. We saw a more moderate gain of 15 percent with the Polar Coordinates test and essentially no difference with the Unsharpen Mask test. We also ran the Lighting Effects filter, which is not SSE-enhanced at this time; there we saw a very small gain of just under 2 percent from the Pentium III processor. The small gain can be attributed to the new floating-point instructions that Intel has included in the Pentium III processor. These instructions can help speed SIMD (Single instruction, multiple data) floating-point operations. Adobe has said that the final release of the SSE plug-in may contain additional optimizations to the filters we used here and other program functions.

We also used an SSE-enhanced version of Microsoft Windows Media Technologies NetShow Encoder. NetShow takes a video clip and compresses it, then stores it to ASF (Advanced Streaming Format) to send to the NetShow server for distribution over the Web. We took an AVI file and encoded it using the MPEG-4 codec in NetShow. The Pentium III's use of SSE code led to about an 8 percent improvement when using the enhanced codec. We saw a comparable gain between the 450-MHz Pentium III and the 500-MHz model.—*Analysis written by Rick Fisco*

How We Tested

All tested systems were equipped with 128MB of RAM and were running Windows 98. Each had a 13.8GB or larger hard disk. We stripped each system's start-up configuration of all processes or tasks except for Systray, Explorer, graphics card control panels, and ActiveX controls. We defragmented the hard disk before each test and let Windows 98 manage virtual-memory settings. For our 2-D tests we set the resolution to 1,024-by-768, true color, and set the monitor refresh to 75 Hz. For our 3-D tests we set the

resolution to 1,024-by-768, 16-bit color, and set the monitor refresh to 85 Hz.

We used Photoshop 5.0.2 with a prerelease version of the SSE plug-in. All filters were tested with the screen set to 1,024-by-768, true color. We maximized Photoshop, closed all palettes, and turned on the status bar for all tests. We waited until all disk activity had stopped before we ran each test. For the Polar Coordinates filter, we set the test image at 25 percent zoom. We set values to 100 percent and Rectangular to Polar within the polar coordinates menu. The Wave filter was set to the following defaults: number of generations—5; wavelength—10 minimum, 120 maximum; amplitude—5 minimum, 35 maximum; scale—100 percent horizontal, 100 percent vertical; repeat edge pixels and type sine at undefined area. The Twirl filter was set to the following default settings: in the dialog box—100 percent and angle 50. We used a 15MB TIF file for all three of the preceding filters.

With the Lighting effects filter, we used a 10MB file zoomed to 33 percent. We used the following default settings: Preview is not selected; Style—RGBlight; Light Type—Spotlight, with the Checkbox for On selected; Intensity—Full (a value of 100); Focus—Wide (a value of 100); Glass—Shiny (a value of 100); Material—Plastic (a value of -100); Exposure—Over (a value of 100); Ambiance—Positive (a value of 100); Texture Channel—Red, with the checkbox for White as high selected; and Height—Mountainous (a value of 100). We applied the Unsharpen Mask filter on a 30MB TIF image. We used the following default settings: Preview unchecked; Amount—50 percent; Radius—1.0 pixels; and Threshold—0 levels. All filters were applied and timed.

We used Microsoft's NetShow Version 3.1.0.2954 video encoder, which has been enhanced with SSE code. We first installed the latest versions of Windows Media Player, Plug-Ins, and Codecs as well as Netshow 3.0 Streaming Media Services. We used a clip from ZD WinBench 99 to perform the test. We chose a 15-second clip compressed with Indeo R3.2 and recorded at 640-by-480, 24 bits, 30 fps. We encoded the clip using NetShow's MPEG-4 codec. We set it to encode at its largest size, 320-by-240, and 30 fps.

BENCHMARK TESTS

▲ High scores are best
 ▼ Low scores are best
 Bold type denotes first place

	ZD Business Winstone 99 ▲	ZD 3D WinMark 99 ▲	ZD 3D WinBench 99: Lighting and Trans- formation ▲	ZD Business Graphics WinMark 99 ▲	ZD CPUmark 99 ▲	Full Screen Scaling* CPU Utilization (percent) ▼	Maximum Frame Rate (frames/sec) ▲
Dell Dimension XPS Pentium II/450	22.8	720	32.4	158	33.3	52	74.2
Dell Dimension XPS Pentium III/450	23.0	771	58.1	160	35.1	52	74.7
Dell Dimension XPS Pentium III/500	24.5	787	63.2	177	38.7	49	74.5

* With an Action, MPEG-1, 352-by-240, 30-fps, 300-Kbps clip

APPLICATION TESTS

Low scores are best
 Bold type denotes first place
 Seconds

	Adobe Photoshop 5					Microsoft NetShow
	Lighting Effects (10MB file)	Polar Coordinates (15MB file)	Twirl (15MB file)	Unsharpen Mask (30MB file)	Wave (15MB file)	
Dell Dimension XPS Pentium II/450	23	20	9	6	7	54
Dell Dimension XPS Pentium III/450	22	17	6	6	4	50
Dell Dimension XPS Pentium III/500	20	16	5	3	4	45

▼ When you're running the typical business applications in Winstone 99, SSE has little or no effect. When application code is optimized for SSE, however, you'll see scores rising from 8 to 43 percent, depending on the optimization and the degree to which the application uses code affected by SSE. Filters such as Wave and Twirl in Photoshop showed the greatest performance boost. Other filters and Microsoft's NetShow got less than a 10 percent boost from SSE. We saw about a 10 percent improvement going from a 450-MHz Pentium III to 500-MHz model on our CPU-mark 99 test, but the Winstone score rose only about 6 percent.



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EXTENDING THE PENTIUM III

What sets the Pentium III apart from the Pentium II (aside from higher clock speeds and different mechanical packaging) is the new Streaming SIMD Extensions (SSE). Formerly called Katmai New Instructions (KNI), SSE provides an instruction set and microarchitectural extensions that will improve the performance of certain applications using SSE features, particularly those that are floating-point-intensive.

SSE can benefit 3-D graphics (especially lighting, transformation functions, and 3-D game physics), 2-D imaging, speech recognition, MPEG-2 encoding, scientific and engineering applications, and even some database applications. Mainstream productivity applications will show little improvement (see our benchmark test results).

Many mainstream users will benefit from SSE acceleration—both in Direct3D games that use DirectX 6.1 with SSE-enabled transform and lighting engines and in those games that include their own transform and lighting engines with SSE code. We also expect many graphics board drivers to use SSE's streaming instructions to move triangle data to and from memory.

The 3DNow! instruction set, developed by AMD, Cyrix, and others, was released last year in AMD's K6-2 and provides a subset of SSE capabilities. Intel chose not to participate in its development. Until the final SSE details are released, we'll avoid direct comparisons of SSE and 3DNow!

KEY SPECIFICATIONS

SSE provides four principal enhancements. There are eight new directly addressable 128-bit floating-point registers (which is the first true extension to the x86 register set since the 80386 was released in 1985), 50 new instructions designed for SIMD (Single Instruction, Multiple Data) floating-point operations, 8 new instructions focused on streaming data to and from memory more efficiently, and 12 new MMX-class SIMD integer instructions called New Media Instructions.

THE NITTY GRITTY

The Pentium III SIMD capability allows four 32-bit single-precision floating-point values to be packed into a 128-bit register. A single SSE instruction would operate on two such registers, performing four simultaneous floating-point calculations.

Unlike MMX, SSE permits concurrent execution of both MMX and SSE instructions, and concurrent execution of standard floating-point and SSE instructions. SSE registers are also directly addressable, with no stack bottleneck, unlike standard x86 floating-point registers.

The memory-streaming instructions enable memory pre-fetching, streaming stores, and enhanced write-combining. *Pre-fetching* permits cache line-sized data elements to be fetched from memory into the CPU, under application control, slightly before they are actually needed, with cache placement control. This helps hide memory latencies. The Pentium III external bus (essentially the same design as in the Pentium Pro and Pentium II) is designed to handle multiple outstanding pipelined bus transactions and enhances the performance of prefetch operations.

Streaming stores let the processor write streaming data (that typically won't be reused, like audio and video streams) directly to memory, bypassing all cache levels—thus preventing cache pollution (where frequently used instructions or data stored in cache are overwritten by far less critical data). *Write combining* allows multiple partial writes to successive memory locations to be combined into a larger single cache line-sized burst write operation in the write buffers. This improves throughput, particularly when used in combination with the Pentium III's bus pipelining. Intel has measured the Pentium III's write-combining bandwidth at 780 MBps, which is close to the theoretical maximum of 800 MBps for its 100-MHz bus.

The New Media Instructions (Integer SIMD) use MMX 64-bit registers and have new instructions that can improve performance of algorithms like motion estimation in software MPEG-2 encoders or aid word- and phoneme-probability matrix calculations in speech recognition software. Streaming stores for SIMD integer operations and conversion from SIMD integer to SIMD floating-point ability have also been added.—*Nick Stam*

conversion from one form to the other can be made without tools in under 10 minutes. The system also comes with a Creative Labs Sound Blaster Live! Card that, when used with the system's stereo speakers and subwoofer, affords brilliantly full audio, complementing Compaq's impressive software-based DVD playback. Unlike some others in this roundup, the unit has free IRQs.

A good performer, this system is truly differentiated by its easy-to-use Internet wizard, which provides 50 free hours online through GTE, and Compaq's Online Services, which let you manage your data and improve your business operations over the

Web. You can back up your files online at a secure site (saving hardware, software, and support costs), create an Internet catalog of your products; access your PC's

files remotely from any PC connected to the Internet, and much more. Compaq received a grade of B on our latest Service and Reliability Survey, and the company supports the system's loaded software and provides some of the market's best setup, support, and small business management tools.—*Cade Metz*



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VENDOR WEB SITES: THE BEST AND THE REST

Today, the quality of a PC company's Web site is nearly as important as the quality of the company's hardware. All seven PCs we reviewed are sold over the Web as well as by phone—even those from such companies as Compaq, CompUSA, and NEC, which are not traditionally direct sales vendors. We carefully investigated the Web sites of our test PC vendors, separating those that make PC ownership significantly easier from those that merely make it less difficult. Much may change by the time you read this, but when we checked sites in late January, Compaq, Dell, and Micron offered the most impressive Internet services. But Dell got the edge: Its site is as effective as it is easy to use. Micron and Compaq lacked features such as troubleshooting guides.

What really sets Dell's site apart is the quality of its Web-based support. New systems will be tagged with an Express Service Code, which when entered under Dell's support Web site will instantly provide you with access to BIOS updates, drivers, manuals, troubleshooting wizards, and diagnostics specific to your hardware. Gateway's support services are nearly as impressive, offering much the same caliber of documentation and driver updates, while Compaq and Micron are a few more steps behind. Offerings from NEC and Quantax are

fair, but CompUSA provides essentially no Web-based PC support. Though CompUSA's Web site details the company's repair policies and posts technical support phone numbers, it lacks readily available software or documentation for those seeking to enhance or service their PCs.

Most sites are fairly good at helping you purchase products on the Web. Like the others, Dell's home page carefully arranges machines into basic categories—in this case, small business, large business, education, home, and government. You can choose a PC by drilling down under one of these categories or by picking directly from a master Products page. Either way, after deciding on a system, you can quickly bring up its standard list of components, then adjust that list (within certain bounds) to satisfy your needs. Additional information such as product specifications is provided on many sites to assist you in your decision making. This Web-based custom configurator was pioneered by Dell, and its like is now being used by many PC vendors, including those here.

After selecting your PC and peripherals, you click on a prominent icon to add the items to a virtual shopping cart and are guided through a simple ordering process. Dell's, Compaq's, and Micron's ordering features are similarly adept, but those on the CompUSA, Gateway, NEC, and Quantex sites are generally more difficult to use. At Gateway's site, accidentally ordering a system is particularly easy, because Gateway's configurator does not make it clear toward the end of the buying process that you will be sending final information (and a purchase order) to the company. —Cade Metz

● CompUSA distinguishes the PC American Pro 500 from its Pentium III brethren with two conspicuous devices: a 15-inch flat-panel LCD and a six-speaker audio system. These items are in many ways beneficial, but they also make the American Pro the most expensive PC in our roundup. Such cost could be justified were it not for the machine's low 3-D graphics score and paltry supply of setup and help tools.

The unit's NEC flat-panel display is a worthwhile purchase if you have limited desk space, otherwise you may be better off with a 19-inch monitor, which CompUSA sells for \$500 less. Of course, if you have limited desk space, you'll hardly welcome the six speakers, massive subwoofer, and control station that constitute the system's Cambridge SoundWorks DeskTop Theatre 5.1. The speakers do afford above-average sound. During DVD testing, the unit was less impressive, typically generating dull, watery images. This, however, is more likely a result of its display than its software-based playback engine.

The low score on our 3D WinMark 99 tests can be traced to the unit's older

graphics driver. Its disk is also slightly slower: an Ultra ATA-33 model instead of the newer Ultra ATA-66. When it comes to ease of use, CompUSA is even more disappointing. The unit ships without a printed user guide, setup poster, restore CD, or customized Internet access wizard, and it offers minimal system-specific information on disk and CD-ROM. It also lacks a free IRQ.—CM

Dell Dimension XPS T500

19.5GB disk, 17" monitor. Business Winstone 99: 24.5. \$2,657 direct. Warranty: 3 years parts, 1 year labor, 1 year on-site service. Dell Computer Corp., Round Rock, TX; 800-388-8542, 512-338-4400; www.dell.com; 543 at www.pcmag.com/infolink.

● Despite a smallish monitor, the Dell Dimension XPS T500 is a very good value. The Dell unit includes hardware-based MPEG playback and a 7,200-rpm hard disk, and though the system did not ship to us with many help tools, we found Dell's PC-support Web site to be the best.

Benefiting from an MPEG-2 decoder card, the Dimension's DVD playback was the sharpest of our roundup and the least likely to be interrupted by hard disk activity. Of course, such playback deserves a 19-inch display, which Dell sells for an extra \$100. Though a good benchmark test performer, the Dimension fared poorly on ease-of-use testing. We found the tested system lacking a restore CD, a



Dell Dimension XPS T500

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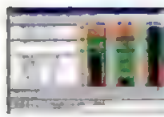


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500-MHz PENTIUM III PCs



	Compaq Desktop Prosignia 330	CompUSA PC American Pro 500	Dell Dimension XPS T500	Gateway G6-500	Micron Millennia MAX 500	NEC PowerMate 8100	Quantex QP6/500 SM-4x SE
Price of tested configuration	\$2,990 direct	\$3,399 direct	\$2,657 direct	\$2,974 direct	\$2,899 direct	\$2,690 street	\$2,549 direct
Installed/maximum SDRAM DIMMs	128MB / 384MB	128MB / 768MB	128MB / 768MB	128MB / 768MB	128MB / 384MB	128MB / 384MB	128MB / 384MB
Motherboard manufacturer	Compaq	Intel	Dell	Intel	Intel	Intel	Biostar
Chip set	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
BIOS version	Compaq 686T9	Phoenix 4.0, Release 6.0	Phoenix 4.0, Release 6.0	Phoenix 4.0, Release 6.0	Phoenix 4.0, Release 6.0	Phoenix 4.0, Release 6.0	Award 4.51pg
Hard disk	21 5GB IBM DJNA-372200	13 8GB IBM DTTA-371440	19 5GB Maxtor 92059D8	16 7GB IBM DJNA-371800	21 5GB IBM DJNA-372200	13 8GB IBM DTTA-371440	12 4GB Western Digital 313000
Hard disk interface/rotational speed (rpm)	ATA-4 / 7,200	ATA-4 / 7,200	ATA-4 / 7,200	ATA-4 / 7,200	ATA-4 / 7,200	ATA-4 / 7,200	ATA-4 / 5,400
Ultra ATA-33/Ultra ATA-66	■ ■	■ □	■ □	■ ■	■ ■	■ □	■ ■
Supports SMART	■	■	■	■	■	■	■
Extra mass storage	Imega Zip100	Imega Zip100	Imega Zip100	Philips CDD3610 CD-R	Imega Zip100	Imega Zip100	Imega Zip100
Graphics card	STB Velocity 4400	STB Velocity 4400	STB Velocity 4400	STB Velocity 4400	Diamond Viper V550	Diamond Viper V550	STB Velocity 4400
Graphics chip set	nVidia RIVA TNT	nVidia RIVA TNT	nVidia RIVA TNT	nVidia RIVA TNT	nVidia RIVA TNT	nVidia RIVA TNT	nVidia RIVA TNT
Graphics memory	16MB SDRAM	16MB SDRAM	16MB SDRAM	16MB SDRAM	16MB SDRAM	16MB SDRAM	16MB SDRAM
MPEG-2 support	Software	Software	Hardware	Software	Software	Software	Software
MPEG-2 decoder	Quadrant International	Quadrant International	CineMaster 3.0	Quadrant International	Win DVD	Quadrant International	Quadrant International
Viewable screen size (diagonal, in inches)	18.2	15.0 (LCD)	16.0	18.0	17.9	17.9	18.0
DVD-ROM drive	5X Creative Labs DVD-113	4.8X Toshiba SD-M1202	4.8X Toshiba SD-M1202	4.8X Toshiba SD-M1202	6X Pioneer DVD-103S	2X Hitachi GD-2500	4.8X Toshiba SD-M1202
Sound device (interface)	Creative Labs Sound Blaster Live! (PCI)	Creative Labs Sound Blaster Live! Value (PCI)	Turtle Beach Montego II (PCI)	Creative Labs ES1373 (Integrated)	Creative Labs Sound Blaster Live! (PCI)	Crystal CS4235 (Integrated)	Creative Labs AudioPCI 64V Legacy (PCI)
Audio synthesis	Wavetable	Wavetable	FM, wavetable	Wavetable	Wavetable	Wavetable	Wavetable
Speakers (all with subwoofer)	Altec Lansing ACS46	Cambridge Sound-Works DeskTop Theater 5.1	Altec Lansing ACS295	Boston Acoustics BA635	Monsoon MM-1000	Altec Lansing ACS45	Altec Lansing ADA 305
Network adapter	None	None	None	None	None	3Com Fast Etherlink XL 10/100 Mbps	Intel EtherExpress Pro 100 10/100 Mbps
Modem	V.90 (K56flex)	V.90 (x2)	V.90 (x2)	V.90 (x2)	V.90 (x2)	None	V.90 (K56flex)
Expansion-bus slots	1 ISA, 3 PCI, 1 ISA/PCI, 1 AGP	1 ISA, 3 PCI, 1 ISA/PCI, 1 AGP	4 PCI, 1 ISA/PCI, 1 AGP	1 ISA, 4 PCI, 1 ISA/PCI, 1 AGP	1 ISA, 3 PCI, 1 ISA/PCI, 1 AGP	1 ISA, 3 PCI, 1 ISA/PCI, 1 AGP	2 ISA, 3 PCI, 1 ISA/PCI, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	2 / 1	2 / 3	2 / 3	4 / 1	2 / 2	3 / 1	4 / 1
Internal drive bays (5.25" / 3.5")	0 / 2	0 / 2	0 / 2	0 / 3	0 / 2	0 / 2	0 / 4
Power-supply wattage/USB ports	145 / 2	235 / 2	200 / 2	200 / 2	200 / 2	200 / 2	200 / 2
Live 24-hour, 7-day toll-free technical support	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/1 year	3 years/1 year	3 years/1 year	3 years/3 years	3-5 years/1 year	3 years/3 years	3 years/1 year
On-site service charge for 1 year	Included	Included	Included	Included	Included	Included	Included

user guide, and electronic documentation. We also had problems with its Internet setup wizard. Dell is supposed to provide 30 free hours of Internet access—via AT&T and GTE—without requiring credit card information but failed to do so. The system also lacks free IRQs.

After we'd voiced our concerns, Dell sent us a user guide and a new Internet wizard (that worked) and claimed it would also provide electronic documentation with each machine, as it has done for its other systems. Dell does not include a restore CD but in lieu of that, the company plans to offer a utility that will keep track of, and if need be, restore past OS settings. Dell earned a A on our Service

and Reliability Survey, and the company's Web site is excellent—serving up drivers, tests, and bug fixes specific to your system.—CM

Gateway G6-500

16.7GB disk, 19" monitor. Business Winstone 99: 25.5. \$2,974 direct. Warranty: 3 years parts and labor, 1 year on-site service. Gateway, North Sioux City, SD; 800-315-2536, 605-232-2000; www.gateway.com; 544 at www.pcmag.com/infolink.

● Equipped with an Ultra ATA-66 hard disk controller card and a CD recordable drive, the Gateway G6-500 is a powerful PC. This mid-tower also benefits from an extensive, though scattered, array of help documentation and software.

Though most of the other PCs in this roundup are connected to their Ultra ATA-66 hard disks via the common IDE interface, only Gateway opted to use a dedicated Ultra ATA-66 controller. Plugged into a PCI slot, it boosted the system slightly above the others in this roundup on our Winstone and 3D WinMark tests. Yet the system's most welcome accessory is probably its Philips CD recordable drive which, coupled with Adaptec's Easy CD creator, backs up data and copies audio tracks in minutes.

With respect to system warranties and help tools, Gateway is among the market leaders, providing three years of labor on the system (one year on-site) and an eclec-

500-MHz Pentium III PCs

tic software-based support engine known as HelpSpot. The company's printed documentation is also helpful, though it inconveniently spans several different manuals. Unfortunately, we initially had serious problems running Gateway's Internet setup wizard and even using its Windows Explorer interface. Not until we changed a BIOS setting and obtained a new wizard from Gateway, which received a B on our Service and Reliability Survey, did the system run smoothly.—CM

Micron Millennia MAX 500

21.5GB disk, 19" monitor. Business Winstone 99: 24.9. \$2,899 direct. Warranty: 3-5 years parts, 1 year labor, 1 year on-site service. Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-833-3443; www.micronpc.com; 545 at www.pcmag.com/infolink.

● Micron has made significant improvements to its Millennia line of consumer PCs over the past few months, offering buyers an easy-to-use Internet access package and a year's worth of free Web-based computer classes through Micron University. Such perks, together with sharp multimedia performance, make the Micron Millennia MAX 500 a proficient, well-rounded product.



Micron Millennia Max 500

Along with the Compaq Prosignia 330, the Millennia offers this roundup's finest multimedia, performing well on our Graphics and 3D WinMark tests and generating remarkably pure DVD audio and video. Of the six PCs we tested that use software-based engines, it provides the most impressive video playback, nearly besting the Dell's hardware-based solution. Yet the Dell's audio subsystem hard-

ly compares with the Millennia's Sound Blaster Live! card and Monsoon speakers. When the flat panel speakers are correctly positioned, the Millennia produces riveting audio.

Though the system came to us with a fair share of help tools, its Micron Easy Internet setup wizard and customized Web browser (providing 30 free hours online from AT&T, with no credit card required) failed to operate as advertised until we received a replacement from the vendor, and much of the documentation we received was out of date. But Easy Internet has worked well for us in the past, and Micron was in the process of writing new documentation as we reviewed the system. Micron received a B on our latest Service and Reliability Survey.—CM

NEC PowerMate 8100

13.8GB disk, 19" monitor. Business Winstone 99: 24.4. \$2,690 street. Warranty: 3 years parts and labor, 1 year on-site service. NEC Computer Systems Division, Mountain View, CA; 888-863-2669, 978-264-8000; www.nec-computers.com; 546 at www.pcmag.com/infolink.

● Unlike the six other systems in this roundup, which are designed for consumers or small businesses, the NEC PowerMate 8100 is meant for the corporate environment. It includes an integrated 10/100-Mbps Ethernet adapter in lieu of a modem and comes preloaded with LANdesk Client Manager 3.3, Intel's DMI-compliant software package. Though the system uses a somewhat slower hard disk than those used by most others, it is otherwise comparable to its competitors.

To wit, despite being a corporate PC, the PowerMate ships with a DVD drive backed by a software playback engine, as well as with an Altec Lansing speaker set backed by serviceable Crystal audio. We had problems running the system's DVD player unless we loaded a disk before launching the software, but this is an adept multimedia PC in all other respects. It is also the only PC reviewed here to have three free IRQs and a full complement of unused bus slots.

Like CompUSA, NEC uses an older 13.8GB IBM hard disk rather than a larger, Ultra ATA-66 drive. Performance was similar to that of the other units on our

Business Winstone 99 test but suffered slightly on 3D WinMark 99, because the system used an older graphics driver. Ease of use was below par as well: As a corporate PC, the PowerMate lacks such extras as a setup poster. The vendor claims that restore CDs are included, although we did not receive one with our test unit. NEC managed a C on our Service and Reliability Survey.—CM

Quantex QP6/500 SM-4x SE

12.4GB disk, 19" monitor. Business Winstone 99: 24.8. \$2,549 direct. Warranty: 3 year parts, 1 year labor, 1 year on-site service. Quantex Microsystems Inc., Somerset, NJ; 800-346-6572, 732-563-4166; www.quantex.com; 547 at www.pcmag.com/infolink.

● Though burdened by a dearth of setup and help tools, the Quantex PC—like Dell's inaugural Pentium III PC—is inexpensive. Its \$2,549 price (the roundup's lowest) includes not only a set of basic hardware components rivaling those of any other PC in this roundup (a slower hard disk notwithstanding) but a 10/100 Ethernet card as well, which is increasingly useful to consumers for fast Internet connectivity through cable or DSL modems—and a welcome addition for businesses.

The QP6 performed well, save for a low score on our 3D WinMark 99 tests. This was due primarily to its graphics driver, which is an older and less optimized version than that used by its competitors. The unit's hard disk is also slower, spinning at 5,400 rpm; all other units had 7,200-rpm models. The drive also affords only 12.4GB of storage space—10GB less than the leading IDE drives available today, and the lowest capacity in this roundup. During audio and DVD testing, the QP6 performed well, letting us—unlike other tested PCs save the Micron—run its DVD player at 1,024-by-768 pixels and 32-bit color.

In terms of ease of use, the QP6 lacks polish: It was shipped to us with a somewhat helpful user guide but lacked a setup poster, a customized Internet wizard, electronic documentation, and a restore CD. Though Quantex intends to include a setup poster with the system, end users must do without the rest. The QP6 has but one free IRQ and uses two 64MB DIMMs rather than a single module.

Quantex received a B on our Service and Reliability Survey.—CM 

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FIRE YOUR BROKER

The do-it-yourself craze hits the world of investing. We review 34 sites to help you research your next market move, track your investments, and buy and sell them online.

Baseball was the national pastime of the 1930s and '40s, fueled by the rise of radio. In the '60s and '70s, football took center stage, because of its ideal suitability for television. The national pastime of the 1990s is the stock market, driven largely by the growth of the Web.

The Web and finance are a match made in heaven, as the minutiae of financial information fits perfectly with the Web's predilection for constantly updated data. The Web has literally thousands of sites devoted to helping you do everything from finding the next Microsoft to following your own stocks to trading online and cutting your broker out of the picture.

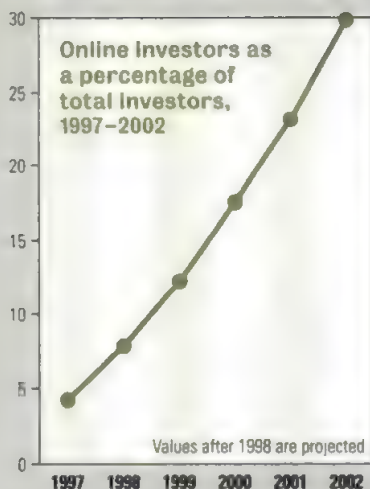
The explosion of readily available financial information and the ability to trade equities directly has even created a new phenomenon: the day trader. We're not suggesting you quit your job to move in and out of thinly traded stocks that zoom up and down on the basis of company press releases and what some poster on Silicon Investor said. In fact, the majority of online traders are buy-and-hold investors. According to International

Data Corp., the traditional discount brokers Fidelity and Schwab together command 55 percent of the online trading market. And with their high online commissions, they're not the brokers of choice for day traders focused on the bottom line. The convenience, ease, and sense of empowerment in making your own trades are what's driving this evolution in the brokerage business.

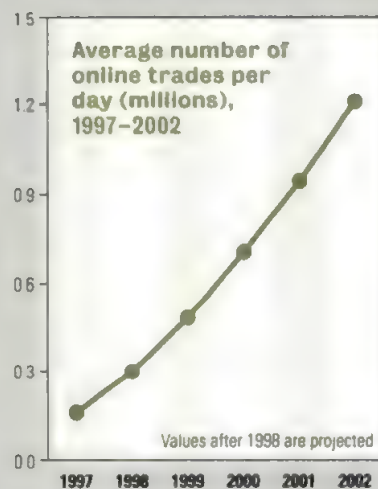
Stock brokers are not quite endangered species yet, because online brokerages are still going through their growing pains. Massive volume can slow these systems to a halt. Often these delays, especially when you're executing an order, can really cost you. The SEC, in fact, has recommended that online traders use limit orders (which let you specify a threshold buy or sell price) rather than market orders (where the system will execute your trade at any price it can find). During our testing, we experienced unreasonable delays only on an isolated basis. The possibility of system irregularities means you'll want to pick a broker with strong customer service, and one



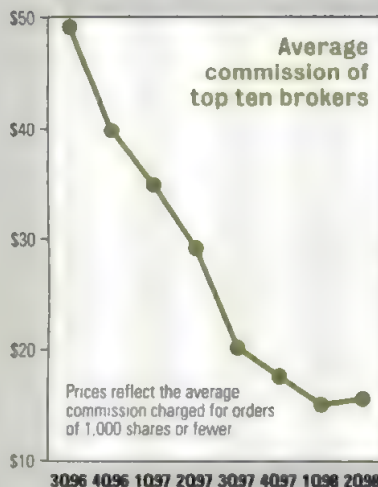
The number of investors is on the rise...



...and they'll be making more trades...



...as commissions are on the decline.



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that has explicit policies for handling trades gone sour because of system foul-ups or slow execution.

You definitely need to do your homework before starting to make your own trades. None of the online brokerages, though, offer research tools at their sites to compete with what you'll find elsewhere on the Web. But they have made progress. A year ago, almost no online brokerages offered research tools; this year, almost every site we reviewed did—as each is trying to distinguish itself from many competitors. Moving forward, we expect online brokerages will pile on more and more value-added services to attract and keep new customers. Today, the key issues when selecting a Web broker are trading speed, low commission costs, and good customer service.

Whether you trade online or not, the Web needs to be an important part of how you handle your investments. You'll want to set up a portfolio that will let you track your holdings throughout the day. The market moves too fast these days not to pay attention to or rely on your broker to tell you what you should know as soon as

possible. The best portfolios, such as MSN Investor's, let you set up alerts based on movement in any of your investments.

The next thing you'll want to do is keep your ear close to the ground. There's no shortage of news, commentary, or advice from financial news sites, message boards, and chat rooms, but you need to separate the dross from the gold.

The Web can also be your primary research vehicle, and we mean more than just acting on what you hear in the chat rooms. The best stock screeners on the Web are highly sophisticated, with scores of filter criteria to help you identify the companies with the credentials and performance that inspire you to invest your money. Mutual fund screeners, though less impressive, will at least help you narrow the field so you can tackle the mass of reports and ratings that'll lead to a winner.

Millions of people are discovering that the Web lets you take control of your investment portfolio in a way that's never been possible before. Read on for the best sites to research, buy, sell, track, and discuss your investments—all with just your PC and an Internet connection.

ONLINE • BROKERAGE • SITES

AMERITRADE

www.ameritrade.com

Geared for day traders, Ameritrade does not deliver as well as its competition on what that audience cares about most—low commissions and fast trade execution. Ameritrade's trade executions in our informal tests took slightly longer than its primary competitors, Datek and SureTrade. The fee for limit orders is a few dollars higher than Datek's or SureTrade's. This will add up in case you plan on being very active.

One thing we really liked about Ameritrade's site is that the trading screens are organized with tabs for traders with beginner, intermediate, or advanced levels of experience. Ameritrade's beginner track is of particular value, because novices can avoid being presented with more choices than they'll want to know about. This represents a definite nod toward the kind of hand-holding a live broker might provide.

We had most of our trades executed immediately through Ameritrade's site, although one day we put in orders to buy shares in American Express and Coca-



EDITORS' CHOICE

ONLINE BROKERAGE

• **E*Trade:** Providing the smoothest, most sophisticated trading experience on the Web, E*Trade is your full-service online broker. No other site makes it as easy for you to see all the relevant information you need to place trades. E*Trade also gives you customer service within the site with intelligent and welcome pop-up boxes—something no one else offers.

We give Datek an honorable mention. If you're interested in being a day trader, the combination of low commissions and very speedy trade execution makes Datek the brokerage of choice.

PORTFOLIO AND STOCK SCREENER

• **MSN Investor:** Setting the standard for portfolio management, MSN Investor delivers a level of detail unmatched in every other Web portfolio combined. Investor automatically calculates stock splits and reinvested dividends, something other portfolios don't do, and it gives you great flexibility in how to view your financial data.

Investor also sets the pace for Web stock screeners, with more than 200 search criteria. Its research wizard walks you through the process, helping to identify what you're looking for while educating you along the way.

MUTUAL-FUND SCREENER

• **None:** We wanted a mutual-fund screener that would give us extensive flexibility as well as all the information that we needed to make a decision. Unfortunately, no one site had everything. Start with the free stuff at SmartMoney and Quicken.com and then move to Morningstar and Thomson's if you need more.

BREAKING NEWS AND ANALYSIS

• **TheStreet.com:** If you want the scoop on what's happening and what it means, and you want it fast and with great aplomb, then you want a subscription to TheStreet.com. This site boasts excellent commentary and consistently gives you the context and understanding you need to make sense of a market that often doesn't make much sense at all.

FINANCIAL DISCUSSION

• **The Motley Fool:** Most financial discussion on the Web is either wistful ("I wish I had bought Yahoo! at \$8 a share"), angry ("Iomega sucks"), or filled with an agenda. We like The Motley Fool: It tends to avoid all of these, instead giving you informed opinion geared toward the everyday investor.

Cola stock, which resulted in waits of over 5 minutes for execution. Considering the liquidity of these blue-chip stocks, we should have had faster execution; all the other sites in this review were faster.

The brokerage's commissions, like SureTrade's, are extremely low—only \$8 for most trades, though limit orders cost \$13. SureTrade charges only \$9.95 for limit orders.—*Sebastian Rupley*

DATEK

www.datek.com

Want to quit your job to beat the market? Datek is the best site for day traders, because of the cheap commissions and rocket-fast trade executions that no one else can match. Fidelity and Schwab have customer service light years ahead of Datek's, but with commissions nearly three times higher, no day trader is going to go

for such a cost of doing business.

The Datek site was very responsive, though during one trade we placed, an error message said the application servers for the request were temporarily unavailable. This was frustrating, but the error message also pointed us to an alternate Web server for quick execution of the trade.

On our other trade requests, Datek provided executions that were faster than greased lightning. A block of American Express shares we moved to acquire was literally bought faster than we could click on the Order Status menu choice. Datek has such confidence in its ability to execute your trades immediately that you won't be charged a commission on any trade that takes more than 1 minute to execute.

One problem we had with Datek was that information supplied in our application came back garbled and incorrect. For

example, the new account listed a completely incorrect social security number.

At \$9.99 per trade, Datek's commissions are outstanding (though not the lowest), and Datek is also one of only a few online brokerages to make no price distinction between a market order and a limit order. Such extras are what make Datek the darling of the day traders.—*SR*

DISCOVER BROKERAGE

www.discoverbrokerage.com

You won't find some of the extras at Discover Brokerage that you will at E*Trade (its most analogous cost competitor), but you'll have no trouble with trade executions. The site is snappy and presents information well, but the wait times on the phone for support are long, and there's no particular feature to recommend it over another brokerage.

Our orders to buy shares of Coca-Cola and Gillette stock were executed in seconds, and we liked the spreadsheetlike format organizing the trading screens. It's easy to spy the current bid/ask spread for

Our Contributors: SEBASTIAN RUPLEY is a senior editor. JAN OZER is a contributing editor of *PC Magazine*. KEVIN CARDANY, EYAL RABINOVITCH, and SARAH L. ROBERTS-WITT are freelance writers, and ADAM ASCH is an editorial researcher at *PC Magazine*. DIANE JECKER was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.

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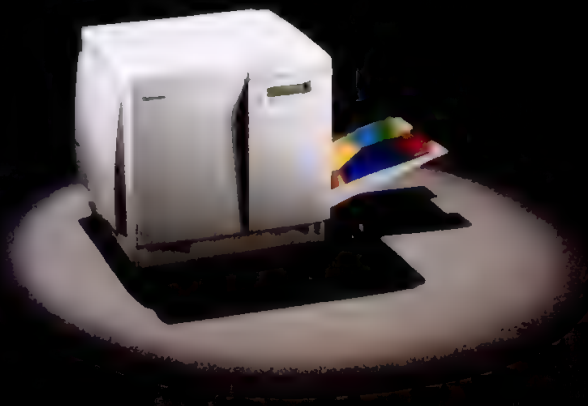
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SCORECARD

ONLINE BROKERAGES



At PC Magazine Labs we felt that the only way to test online brokerage sites properly was to execute trades.

We opened an account at each site, taking note of what was required to begin trading, particularly each site's security policy and registration requirements.

Once the sites gave us the go-ahead to begin trading, which ranged from immediately to ten days, we evaluated their research tools (stock screeners, reports, and so on) for stocks we were interested in purchasing.

With this ammunition, we moved on to the fun stuff: performing trades. On the purchasing side, we not only tested how to buy stocks with market orders (buying at the current "market price"), we also investigated other types of orders, such as limit orders, sells, and after-hours trades. We executed trades at each

brokerage from both a 33.6-Kbps modem and a T1 connection.

Our transactions score for day traders considers execution speed, cost of trades, and organization of important trading data immediately visible on the screen when placing trades. For buy-and-hold investors, the score represents a review of each site's execution speed and both the timeliness and content of the trade confirmations we received.

Customer service is an important aspect of the trading experience. We tested it by repeatedly e-mailing and calling each site's customer service, noting the delay before we received a satisfactory response.

We also reviewed the design of each site in this review roundup for its interface, navigability, and integration of features.—*Diane Jecker*

	Ameritrade	DataK	Discover Brokerage	DLJdirect	E*Trade	Fidelity	Schwab.com	SureTrade	Waterhouse Securities	Web Street Securities
POWER										
Transactions										
Day trader	Fair	Excellent	Good	Fair	Good	Fair	Fair	Good	Good	Good
Buy-and-hold investor	Good	Excellent	Excellent	Good	Excellent	Excellent	Good	Excellent	Excellent	Excellent
Customer support	Good	Fair	Fair	Fair	Excellent	Good	Excellent	Fair	Excellent	Fair
Interface	Good	Fair	Fair	Fair	Excellent	Fair	Fair	Excellent	Good	Excellent
Reporting	Good	Good	Good	Excellent	Good	Good	Excellent	Good	Good	Good
Research	Good	Fair	Poor	Good	Excellent	Good	Excellent	Poor	Excellent	Good
EASE										
Transactions										
Day trader	Fair	Excellent	Excellent	Good	Excellent	Good	Good	Good	Excellent	Excellent
Buy-and-hold investor	Good	Excellent	Excellent	Good	Excellent	Good	Good	Excellent	Excellent	Excellent
Customer support	Good	Fair	Fair	Fair	Excellent	Excellent	Excellent	Fair	Excellent	Fair
Interface	Excellent	Fair	Fair	Fair	Excellent	Good	Good	Excellent	Good	Excellent
Reporting	Good	Good	Good	Excellent	Excellent	Good	Good	Good	Good	Good
Research	Excellent	Good	Good	Good	Excellent	Good	Excellent	Good	Excellent	Good

a stock just before placing a trade.

Compared with E*Trade's site, though, Discover's is not as rich or well designed. At Discover you must use straight links to move among the site's various features. In contrast, E*Trade's tabbed file-folder format makes it easy to move around from a trading screen to a balances screen, for example. Also, Discover's help isn't as readily available as E*Trade's pop-up messages, simulating a live broker's help.

Customer service was a little schizophrenic. We really liked that when we went to register a password for placing trades, the site came back and warned us that the password we chose could be "easily guessed" and that we might want to pick

something more obscure. But of more concern was our difficulty in getting through to Discover's brokers on the phone. We sat on hold for more than 20 minutes on more than one occasion. When you urgently need to make a move or receive some advice in this volatile market, a wait like this is generally not acceptable.—*SR*

DLJDIRECT

www.dljdirect.com

New to the online trading game, and seeking to act on a hot tip before it's too late? DLJdirect will let you do it. You don't need an initial deposit to get started and can be trading within 15 minutes. You

don't get as much context when placing trades as you do at E*Trade or SureTrade, and the site's telephone customer service was a definite minus, so you'll need to consider whether you'll be using a live broker as well as trading online.

Placing several trades at DLJdirect's Web site, we found the trading screen somewhat stripped down compared with the very informative ones in this roundup. E*Trade's, for example, lets you see the current bid/ask prices and other information on the stock right as a trade is executed. DLJdirect's screens supply the parameters of the current trade you are placing—and little else.

Customer service at DLJdirect varied



Why does the moon
stay in the sky?

What makes
the stars twinkle?

How does
the Internet work?

Actually, it works very well. Maybe because so much of it runs on Compaq. Four out of the five most popular Web sites are powered by Compaq. Hundreds of millions of hits are handled by Compaq platforms every day. Three-quarters of

the top ISPs have standardized on Compaq for their Windows NT[®] based Web hosting. And if you've ever received e-mail, chances are, we helped get it to you. To find out how the Internet can help grow your business, feel free to ask the source at 1-800-AT-COMPAQ. Or visit www.compaq.com/moon.

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depending on the medium. We experienced very long waits on hold when calling customer service—as long as 20 minutes, which is a lot when your money is on the line. At the same time, no brokerage performed better when e-mailing immediate trade confirmations and other up-to-the-minute information for us than DLJdirect.—SR

E*TRADE

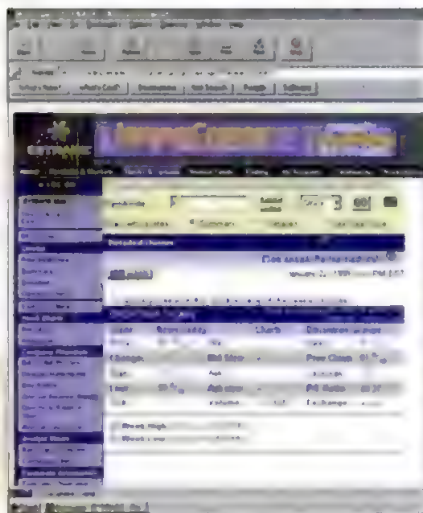
www.etrade.com

PC With fast trade execution, good customer service, reasonably priced commissions, and a much more mature Web site compared with those of other brokerages, E*Trade covers every angle. Day traders focused on keeping expenses low should opt for Datek, but E*Trade is the broker for the rest of us.

E*Trade's depth made itself clear in numerous ways as we placed trades. The trading screens are without peer. These are the key screens, because they're what you view before you send your money floating through cyberspace. When we went to buy some shares in American Express stock, we saw the current bid/ask prices and other information on the stock right as our trade was executed (letting us know whether we achieved a good buy price).

The site is also organized in a tabbed file-folder format, which conveniently lets you flip from the trade preview screen to other relevant information. Let's say you are previewing a trade and are about to enter it. At E*Trade, one click on the appropriate

E*Trade makes it easy for you to get all the info you need before making a trade.



tab pops up your current holdings.

E*Trade's fees place it in the middle of the pack. Its minimum to open an account is \$1,000. But with \$14.95 market orders and \$19.95 for limit orders, frequent traders will feel the pinch when comparing it with the much cheaper Datek and SureTrade.

We got fast trade executions at E*Trade, and its programmed customer service is excellent. For example, we bought several shares of Gillette on one day, and several shares more on another, getting different buy prices. When we went to sell some (but not all) Gillette shares, E*Trade popped up a message asking us whether we wanted to sell the first block of shares bought or the second.—SR

FIDELITY

www.fidelity.com

On the Web, where an old Net company is one about to celebrate its fifth anniversary, think about this: Your parents may have opened a Fidelity account to help build your college fund. Brokerage stalwarts such as Fidelity and Schwab have been in business much longer than Internet start-ups such as Ameritrade and E*Trade. For the buy-and-hold investor who won't care as much about the high commissions here, and especially for those of you who are Fidelity fund investors, Fidelity is a great choice.

We found Fidelity's Web site to be one of the fastest in this story, and this was true for every trade we placed in our account,

both during and after market hours. Our trades were executed and reported on in less than 1 minute in each and every case. Fidelity's trading pages are lean on information when compared with a site that aims for richness of current financial data—such as the ones at E*Trade or Web Street Securities.

The speed and efficiency of trades at Fidelity's site would

make it extremely attractive to timing-oriented investors such as day traders, except commissions at Fidelity are quite a bit higher than at many other brokerage sites in this roundup. The standard commission Fidelity charges for market orders is \$25.—SR

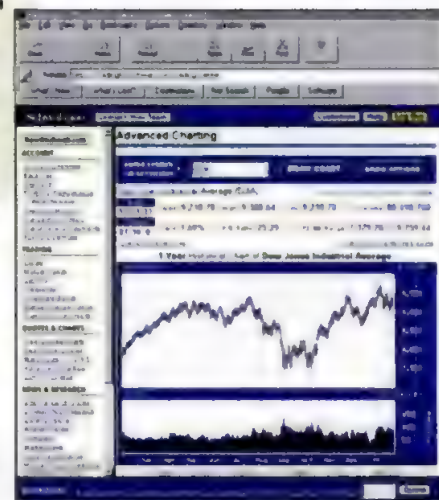
SCHWAB.COM

www.schwab.com

For investors interested in excellent customer service and the security of knowing that their brokerage isn't some fly-by-site operation, Schwab.com is a great choice. Schwab is not only the biggest discount brokerage in the real world, it is also the largest online broker, with one-third of the market. As with Fidelity though, you will pay higher commissions, which may not make fiscal sense for an active trader.

One thing that struck us as we evaluated customer service in this roundup was that these companies are essentially in

Schwab.com offers excellent customer service, but you'll pay for it.



the business of not answering the phone. You'll dig long and hard to find even a phone number at most sites. Schwab, in delightful contrast, gives you a link to the customer support number right on the home page.

When we dialed the number, we got through to helpful personnel with no hold times—every time. All the other brokerages put us on hold, some for very long waits. And with a Schwab.com account, you'll get access to Schwab's world-class phone brokers for advice.

Our buy and sell orders were executed immediately here, and we liked that we

ONLINE BROKERAGES ♦ FACTS AND FIGURES



www.ameritrade.com

To open account **\$2,000**. Market orders **\$8.00**. Limit orders **\$13.00**. Customer-service hours **6:00 A.M.–10:00 P.M. M–F**. Customer-service number **800-454-9272**. Alternative trading methods **Broker, Touch-tone**.



www.fidelity.com

To open account **\$5,000**. Market orders **\$25.00**. Limit orders **\$25.00**. Customer-service hours **24 hours, 7 days**. Customer-service number **800-544-6666**. Alternative trading methods **Broker, Touch-tone**.



www.datek.com

To open account **\$2,000**. Market orders **\$9.99**. Limit orders **\$9.99**. Customer-service hours **8:00–7:00 M–F**. Customer-service number **888-463-2835**. Alternative trading methods **Broker**.



www.schwab.com

To open account **\$2,500**. Market orders **\$29.95 plus 3¢ per share over 1,000**. Limit orders **\$29.95**. Customer-service hours **24 hours, 7 days**. Customer-service number **800-435-4000**. Alternative trading methods **Broker, Touch-tone**.



www.discoverbrokerage.com

To open account **\$2,000**. Market orders: **\$14.95 plus 1¢ per share over 5,000 shares**. Limit orders **\$19.95**. Customer-service hours **24 hours, 7 days**. Customer-service number **800-347-2683**. Alternative trading methods **Broker, Touch-tone**.



www.suretrade.com

To open account **No minimum**. Market orders **\$7.95**. Limit orders **\$9.95**. Customer-service hours **7:00–6:00 M–F**. Customer-service number **401-642-6900**. Alternative trading methods **Broker, Touch-tone**.



www.dljdirect.com

To open account **No minimum**. Market orders **\$20.00 plus 2¢ per share over 1,000**. Limit orders **\$20.00**. Customer-service hours **24 hours, 7 days**. Customer-service number **800-825-5723**. Alternative trading methods **Broker, Touch-tone**.



www.waterhouse.com

To open account **\$2,000**. Market orders: **\$12.00 plus 1¢ per share over 5,000**. Limit orders **\$12.00**. Customer-service hours **24 hours, 7 days**. Customer-service number **800-934-4410**. Alternative trading methods **Broker, Touch-tone**.



www.etrade.com

To open account **\$1,000**. Market orders: **\$14.95**. Limit orders **\$19.95**. Customer-service hours **8:00–6:00 M–F**. Customer-service number **800-786-2575**. Alternative trading methods **Broker, Touch-tone**.

All customer-service hours are eastern time



www.webstreet.com

To open account **No minimum**. Market orders **\$14.95**. Limit orders **\$14.95**. Customer-service hours **24 hours, 7 days**. Customer-service number **800-932-8723**. Alternative trading methods **Broker**.

could get real-time quotes at the bottom of the trading screen even as we entered the parameters for a trade. No site in this roundup did a better job executing after-market trades immediately at the opening of the next day's trading session.

Schwab also does a nice job tracking and reporting account balances. As soon as you log on, the site greets you with real-time balances. This is extremely helpful and not found at the other sites.

The downside to Schwab is high commissions: the highest in this roundup. The commission for any stock trade up to 1,000

shares is \$29.95—double that of E*Trade, and triple that of Ameritrade.—SR

SURETRADE

www.suretrade.com

Closely competitive with Datek for day trader business, SureTrade boasts the lowest prices in our review for market and limit orders. Datek still gets the nod for day traders though, because its screaming-fast trade execution bests SureTrade. Datek's fees for limit orders cost basically as much as they do at SureTrade (the dif-

ference is only 4 cents), and that eliminates any real cost benefit.

One of the things we liked best about SureTrade was the trading screen. It does not place as many infobytes in front of you while making a trade as Web Street Securities' frames-based trading screen does, but it's very good. As we entered a stock transaction, the status of current trading was constantly updated. This is helpful information if you decide, say, to jump out of the market order you are entering and place a limit order instead as a result of the spread between the current bid price and the ask price.

SureTrade typically executed our trades quickly, although it couldn't beat Datek's immediacy. We also found that either order executions or reporting were slow in a couple of instances. For example, an order we placed to buy shares in Gillette stock—a very liquid security—took a very long 3 minutes before the status of the trade was changed from pending to executed.—SR

WATERHOUSE

www.waterhouse.com

An excellent brokerage for those looking for strong human customer service without incurring some of the higher fees you'll find at Fidelity or Schwab.com, Waterhouse Securities may represent a solid middle ground for investors making the transition to Web trading. One caveat: If you're interested in dabbling in trading the never-dull Net stocks, Waterhouse is not the place, because of its severe restrictions on placing orders for many notable Web stocks.

When you open a new account with Waterhouse, you are assigned an account officer at a branch in your area. From a customer service perspective, this is a big advantage, because personal attention is easier to get and waits on hold are minimized when you call. We got through to our local branch quickly every time.

Our trades were executed quickly at Waterhouse, and for every trade we placed, Waterhouse's Order Status report showed a fill as soon as we checked. The trading screen is organized efficiently, with a mix of navigation assistants including ubiquitous drop-down menus and buttons that execute tasks such as bringing up news items. But

SONY



By all means, think **outside the box**. Just put it **all back** when you're done.

10

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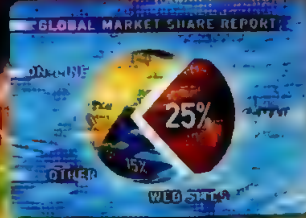
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E*Trade's preview screen is richer.

Waterhouse charges a \$12 commission for any stock trade up to 5,000 shares, placing it on the low end of the middle-pricing tier. Notably, the company does not charge more for limit orders than market orders.—SR

WEB STREET SECURITIES

www.webstreetsecurities.com

In contrast to Schwab.com or Waterhouse Securities, which are not good places to trade Net stocks because of their restrictive policies, Web Street Securities may be your brokerage of choice for trying your hand at day trading. It has a well-organized interface, free commissions on orders of 1,000 or more shares of NASDAQ companies' stock (including those of most Web-based companies), and no minimum start balance to open an account.

The downside, though, is that you may

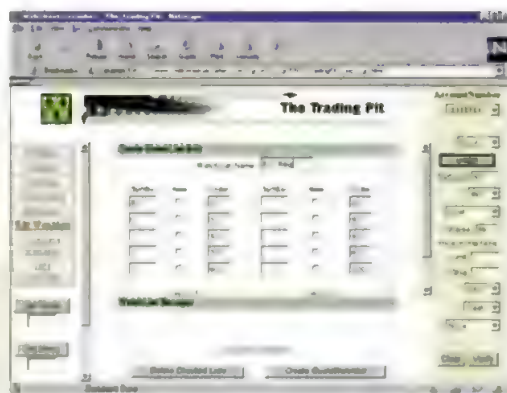
not be able to get customer service when you really need it. We found our wait times when calling Web Street were very long—up to 20 minutes.

Our trades were executed quickly and easily at Web Street's site. We particularly liked the organization of its trading screens. The form you fill out when placing a trade

pops up in a frame on the far right of the main trading page, letting you also view information in other frames.

For example, we set up a trade to buy shares in Coca-Cola stock on the right side of the screen, even as we reviewed the Order Status window to see if a trade we had placed to buy Gillette shares had been executed yet. Day traders who fire off multiple trades in quick succession will

Web Street lets you quickly jump to relevant info before placing a trade.



want to take a close look at this frames-based approach. But for investors who simply want the best organized site (the trading screen being only a subset), E*Trade's tabbed file folders are the best.

Web Street's commissions are average—\$14.95 per trade. But for frequent buyers and sellers of NASDAQ stocks trading in a reasonable size, Web Street could represent a significant long-term commission advantage over other brokerages.—SR

FINANCIAL INFORMATION SITES

PORTFOLIO MANAGERS



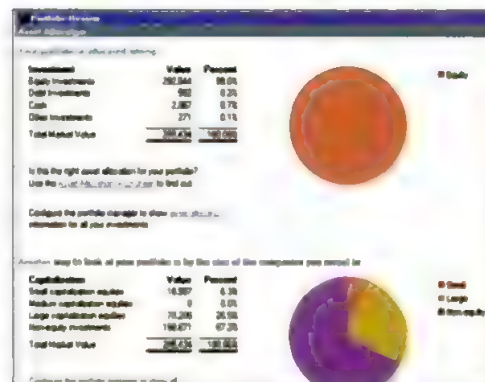
With the volatility in this current stock market, the days of just investing and then dropping those stock certificates in your bottom drawer are over. The Web lets you follow your investments with all the detail of a baseball box score, but it's Timmy's college fund on the line and not a pennant. You'll find lots of Web sites that offer portfolio management capabilities, but few offer everything you'll need.

Most portfolios on the Web can track price and total value of your U.S. stocks and funds as prices vary through the day. We looked beyond this bare minimum, though, seeking out features such as transaction tracking to simplify tax reporting and investment performance, monitoring of international investments, and e-mail or pager notification when prices hit specified levels. We also looked for portfolio analysis tools, revealing composite investment by market capitalization or by indus-

try segment or geographic region.

In terms of pure portfolio capabilities, no one does it better than **MSN Investor** (www.investor.com). First, you have to download the latest Investor software, which is well worth the 5 minutes it takes over a 28.8 modem. After that, getting started is simple, with extensive portfolio import capabilities and wizards to speed data entry. Investment coverage is extensive, letting you track stocks, bonds, CDs, money market funds, and stock options.

MSN Investor, whose portfolio is free,



automatically handles stock splits and reinvested dividends—saving hours of meticulous data entry. It also offers real-time quotes and e-mail and pager alerts.

Investor isn't perfect though. Its portfolio analysis lacked data views provided by Morningstar and Quicken. And Yahoo! Finance provides news—which can explain significant stock movement—from a wider range of sources.

Morningstar's (www.morningstar.net) analysis tools are excellent, but the site suffers from a slow, often clunky interface, and portfolio functions are only average. On the plus side, the Portfolio X-Ray reveals details such as investment by industry segment and world region and investment expense and performance comparisons. You'll have to pay \$9.95 a month or \$99 a year to get all X-Ray categories.

Quicken.com's (www.quicken.com)

portfolio feels disjointed and has some surprisingly rough edges, like forcing users to calculate average stock basis rather than computing it for you. We also received many frustrating "portfolio not available" errors during our tests, although Quicken says those problems should be remedied soon. But the free

ONE-STOP FINANCIAL SHOPS

If you want to get all your financial resources in one place, which site should you visit for everything you need?

★★★★—BEST	Portfolio	Stock screeners	Mutual fund screeners	Breaking news and analysis	Financial discussion	Extras
 Keyword: Personal Finance	★★★★ Easy to create multiple portfolios and modify views; no advanced transaction entry.	★★★ Only 15 screening criteria; insufficient for advanced searches.	★★★ 13 basic search criteria, including Morningstar's star ratings.	★★★★★ Content from Bloomberg, TheStreet.com, The New York Times, Business Week, and more.	★★★★★ Financial celebrity chats make the difference; well-populated investor and live news chats.	★★★★★ A plethora of advice from name-brand sources for both beginner and advanced investors.
 cbs.marketwatch.com/ newsroom.htx	★★★★ Easy to build and modify; can set long or short position.	★★★ 22 search criteria; uses Hoover's stock screener, so good company info.	★★★ No screening tools, but does work for you with Top 100 SuperStar funds—the best of the best.	★★★★★ Wire stories go up early, followed by good original analysis pieces.	★★★ Active, not always smart, message boards; easy to see replies to your messages.	★★★★ Hot Stock Tracker gives you 5 price quotes automatically each time you visit; lots of personal finance tips.
 moneycentral.msn.com	★★★★★ Has the best portfolio feature in its class.	★★★★★ More than 200 screening criteria and a wizard to guide you.	★★★★ More than 100 search criteria, but no specific Morningstar data.	★★★★ Original content, Merrill Lynch news, and headlines from MSNBC.	★★ Have to use news reader to view boards; can't search; boards too general.	★★★★★ Strategy Lab—6 pros play out trading scenarios with funny money; excellent e-mail alerts.
 www.quicken.com	★★★★ Must set up cost basis manually, but you can do it; has excellent alerts.	★★★ Compare up to 33 companies side by side; 6 canned searches.	★★★ Only 20 basic search criteria, but lots of excellent analytical data from Morningstar and Value Line.	★★★ Limited content from CBS MarketWatch, TheStreet.com; related wire stories with quotes.	★★★ Company boards and chat run by Excite; takes you out of financial context to Excite site.	★★★★★ Java QuoteTracker puts portfolio on desktop; print-friendly portfolio; easy stock comparisons.
 quote.yahoo.com	★★★★ Java portfolio manager better for entry, but unwieldy to view.	★★★ Simple; 9 indices. You can't easily modify results.	★ Very basic with just 8 search criteria; no definitions of criteria.	★★★★ Repurposed use of TheStreet.com and Motley Fool; lots of wires and links.	★★ Message boards a bit better than chat; lots of clutter.	★★★★★ Lots of links to other Web content, including international finance sections.
 www.zdii.com	★★★ Too difficult to create and then modify; only the basics.	N/A Not applicable: Interactive Investor has no stock-screener feature.	★★★ About 15 search criteria; no advanced analysis.	★★★★ Tech-market info only, but great stuff	★ Only company boards; not much action.	★★★★ The Day Ahead, a tech-market preview e-mail; Red Herring info on IPOs.

tools let you analyze your portfolio's asset allocation and sector diversification, making Quicken worthwhile for investors concerned with balancing their portfolios. Quicken also shines in giving you total financial planning, with its excellent insurance, mortgage, and retirement planning sections.

Yahoo! Finance's (quote.yahoo.com) portfolio is competent and easy to use but lacks advanced features and analysis tools. The site excels at keeping you abreast of news and other content from a useful variety of sources and is unusually responsive.

Data-entry problems plague Thomson Investor Network's (www.thomsoninvest.net) portfolio, where you can lose input data searching for a stock symbol or by misentering data. News junkies, however, will love the Live Ticker, which scrolls market index, current price, and breaking news on your investments.—Jan Ozer

STOCK SCREENERS



Where do you get your stock tips? "Squawk Box" on CNBC? A friend at the club? The Internet has helped democratize the mystifying notion of what to invest in, by offering tools that let you prioritize what's most important to you in an investment and then providing stocks that meet those criteria. You can also check out potentially desirable stocks and get back data to help analyze your choices.

Stock-picking tools come in two flavors: preset searches, which implement canned search criteria, and custom searches, in which you select your own criteria. Information and analysis is power, but only if you can understand the data.

So it's important to consider not only the breadth of information but also organization and graphical and other tools that help you assimilate the data.

MSN Investor (investor.msn.com) rises to the head of the class, but there is a tuition fee. You'll have to pay \$9.95 per month for custom searches. Investor's custom search function is clearly worth the price, though. It's exceptionally broad and flexible, with more than 200 search criteria, complemented with thorough financial analysis, Zacks' analyst's recommendations, and insider trading data.

Investor's unique research wizard walks you through a structured analysis of potential investments, looking at financial fundamentals, price comparisons, insider purchases and sales, and advisor alerts.

You get two quality stock screening tools at the free site **Market Guide** (www.marketguide.com). NetScreen is a Java application that lets you use 20 screening vari-

ZDNet



believe in technology **ZD**

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Another Type Z Personality.



My real job is being a single dad, but my business card says I'm an architect.

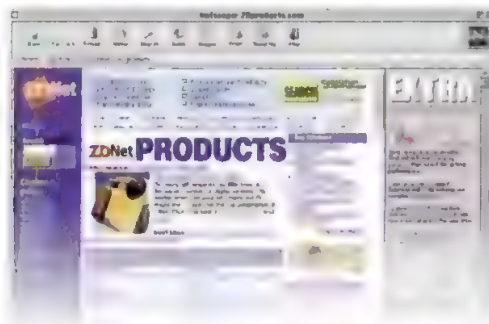
The other day we're upgrading the office, and I'm doing the buying. We need five screaming Intel® Pentium® II boxes, two PC servers and several color printers. So I pop onto ZDNet's Products Review channel to read some reviews, then click over to computershopper.com to shop, compare and buy. An hour later my work is done.

So I take off a little early, swing by Kate's daycare and head home. I make us some sandwiches and we get to work on my favorite housing project yet.

I love it when I get stuff done.

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Visit www.zdnet.com/typez and tell us why you think you're Type Z. If our judges agree, you could win a fantasy adventure trip for two.



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www.zdnet.com



ROUNDING OUT YOUR LINK PORTFOLIO

BEST IPO TRACKING

Whether to get in on the ground floor of the next big thing or for an interesting harbinger of the market's health, tracking new issues is becoming increasingly important for active investors.

IPO Maven (www.ipomaven.com) suffers from poor site design, but it offers the most in-depth free profiles as well as a calendar of upcoming filings and pricings.

BEST INSIDER TRADING INFO

Knowing what company insiders are doing with their stock holdings can be an excellent indication of that corporation's future prospects. **InsiderTrader.com** (www.insidertrader.com) offers a history of insider trades from the last 13 months for free, and premium services that include e-mail alerts on specific

company transactions.

BEST WHISPER NUMBER INFO

Whisper numbers are essentially informed guesstimates of expected earnings put together about three weeks before a company releases its quarterly earnings. They can often have a dramatic effect on stock prices regardless of official company earnings. **EarningsWhisper.com** (www.earningswhisper.com) includes a calendar of upcoming earnings reports, a message board dedicated to each company, and recent

stock and earnings histories.

BEST FREE REAL-TIME QUOTES

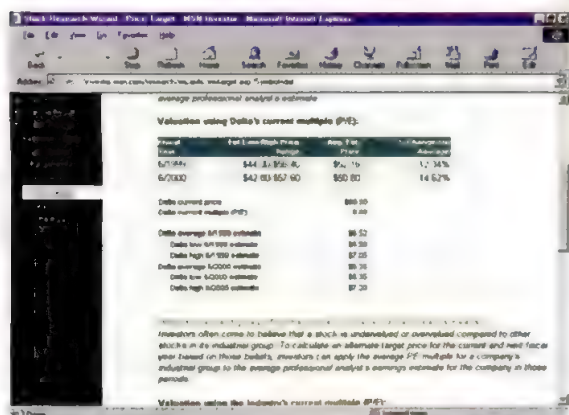
A time-delayed quote is old news. What makes **freerealttime.com** (www.freerealttime.com) so appealing is that it's the only site we've found that gives you an unlimited number of lookups for an unlimited period of time just for registering.

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ables such as number of employees, stock price, and market cap to find a stock. StockQuest is a 12MB download that lets you perform sophisticated searches with more than 50 ratios, statistics, growth rates, and data items. Although similar to Investor's

share or revenue per employee.

Thomson Investors Network's (www.thomsoninvest.net) stock-picking tools are meager, but the site provides an exceptionally useful summary of analyst and investment data



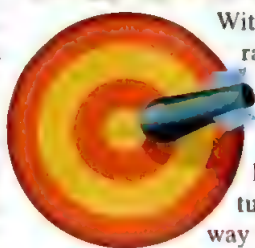
Investor's research wizard offers structured analysis of potential stocks.

Call earnings estimates and holdings by funds, institutions, and insiders.

Fund maven **Morningstar's** (www.morningstar.net) premium service costs \$9.95 per

month and provides detailed information about fund holdings of individual stocks, along with Morningstar fund ratings.—JO

MUTUAL FUND SCREENERS



tool, StockQuest's interface isn't as good as Investor's pull-down menus, and you don't get as much company information. Those interested in a download-free, complimentary service should check out **Hoover's Online** (www.hoovers.com), which can search for stocks using up to 22 financial criteria. The true strength of Hoover's, though, is as a clearinghouse for news and analysis from a number of sources, including its in-house research.

You get more search criteria at **Quick-en.com** (www.quicken.com), which offers six free canned searches. Quicken also provides analysts' summaries, insider trading reports, and the ability to compare up to 33 companies side-by-side using metrics such as earnings per

With all the financial rags screaming out at you from the newsstands about this year's 25 Most Intriguing Mutual Funds, the only way to find out which fund is really going to let you retire in style is to do some research yourself. Fund-picking tools have two elements—

search tools and information—and we evaluated all sites based on both criteria.

Thomson Investors Network (www.thomsoninvest.net) features a fund selection wizard that walks you through a series of well-documented selection criteria, which we found helpful though somewhat ungainly, because of frequent screen refreshes. As with its stock tool, Thomson's presents its full report (\$34.95 yearly for 25 reports per month) on one long page, avoiding the frustrating delays experienced with sites that break their data into screen-size chunks.

Thomson's analysis is extraordinarily thorough and does a great job graphically representing portfolio and performance data. But one problem is that it uses its sister company's Wiesenberger Rating rather than the familiar Morningstar ones.

MSN Investor's (investor.msn.com) search function was flexible and comprehensive, with more than 100 search criteria. On the research front, Microsoft presents performance analysis and portfolio data, Morningstar ratings, and a Value Line Fund review. Also available is an excellent research wizard, which walks you through various fund-analysis measures.

That said, Investor lacks several critical pieces—including historical bear market performance—and the Morningstar ratings were general ones, not category ratings, which was often confusing. For example, you might have a four-star fund, but within the technology sector, it's only a two-star fund.

We found **Morningstar's** (www.morningstar.com)

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USA Today (12/14/98)

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QUICKEN VS. MONEY

The two dominant personal finance packages are tying themselves more and more closely to their Web sites. Which one does a better job?

QUICKEN DELUXE 99

Credits: WebEntry lets you enter bank transactions (bill paying, transfers, and deposits) from any computer connected to the Internet. Once you get back home, the transactions—which are secured with a user name and password—are downloaded to your Quicken Deluxe 99.

With Reminder Export, reminders to pay bills can be uploaded to the Web where they will pop up the next time you log on to Quicken.com.

Portfolio Export uploads stock and mutual fund holdings to Quicken.com. You can check the current value of your portfolio from anywhere you have access to a Web browser.

Debits: Quicken.com flags which transactions have been downloaded to Quicken Deluxe 99 using WebEntry, but you then have to delete them manually from the Web site. WebEntry won't let you record changes to your investment accounts.

You can make changes to your Quicken.com portfolio, but there is no way to download these changes to your portfolio in Quicken Deluxe. You'll have to enter the changes again manually.



Verdict: If you use your personal finance software primarily for managing your investments, then Microsoft Money 99 is the way to go, because it's linked with the easy-to-use and powerful Investor Web site.

If banking, bill payment, and other financial planning elements are more important to you than investments, Quicken.com and Quicken Deluxe 99 are probably more for you.

—Kevin Cardany

MICROSOFT MONEY 99

Credits: After registering with the Money-Central Web site, you can link your Microsoft Money 99 investment accounts to an online portfolio using Microsoft Investor. The Investor portfolio is a more powerful and easy-to-use tool for online management of your stocks, bonds, and mutual fund investments than its counterpart on Quicken.com.

Current financial news and articles are automatically downloaded to your Money 99 Home Page when you connect to the Internet. You can even customize the types of news and information that appear based on your interests.

Quicken merely gives you links to news and is not configurable.

Debits: Money 99 doesn't offer anything similar to the WebEntry or Reminder Upload features found in Quicken Deluxe.

If you've linked your Money 99 investment accounts to your Microsoft Investor online portfolio, you can't make changes to your portfolio online.

You must pay for Investor's advanced features after a free six-month trial.

.morningstar.net) advanced fund-search function comprehensive but unintuitive in operation and lacking somewhat in flexibility. As you would expect, the site provides a wealth of performance and portfolio details, with extensive historical data and access to Morningstar's own editorial analysis. You'll also find active, intelligent discussion groups.

The information is comprehensive yet frustratingly compartmentalized into

often-unintuitive categories, requiring frequent page flipping to find desired details. Nevertheless, if Morningstar ratings are critical to your purchase decisions, pay \$9.95 each month for the complete story.

Those interested in free research will find **SmartMoney.com's** (www.smartmoney.com) fund search tool capable but less flexible and lacking some advanced criteria offered by fee-based sites. SmartMoney's SnapShot provides an extraordinarily use-

ful two-page overview of fund portfolio and performance, though SmartMoney eschews Morningstar and Wiesenberger ratings in favor of its own grading system.

Quicken.com's (www.quicken.com) fund selection tool provides 20 basic search criteria with little granularity, which may frustrate advanced users. But Quicken offers Morningstar and Value Line ratings, bear market performance statistics, and the ability to chart net asset value against up to eight other funds, all at no charge.—JO

BREAKING NEWS AND ANALYSIS



With the Dow and NASDAQ bouncing around more than sports fans in the cold, you need a reliable source to help you make sense of it all. The Web abounds in sites

devoted to reporting and analyzing the current chaos of the world financial markets. Here is how six of the most prominent sites stack up.

TheStreet.com (www.thestreet.com) and **CBS MarketWatch** (cbs.marketwatch.com/news/newsroom.htm) represent the top tier of financial coverage on the Web. Even though TheStreet.com will run you \$9.95 per month or \$99.95 per year for unlimited access while MarketWatch is free, we think TheStreet.com's subscription fee is money well spent for its star-power commentary and unsurpassed analysis.

The big selling point for TheStreet.com is its columnists, particularly James J. Cramer, the hedge-fund manager/journalist who on a busy day may post an astounding six columns to give you instant insight into the trading experience. The site also excels at putting financial news, such as mergers, in industry-specific perspective in a way no one else matches.

Both sites excel at getting in-depth news stories posted quickly, and MarketWatch posts bare-bones wire stories before its own reported pieces get published. But MarketWatch lacks the kind of must-read columnists that TheStreet.com has. We do like MarketWatch's personalization features, which TheStreet.com lacks—such as the Hot Stock Tracker,



which lets you focus on personal points of interest.

For world-class reporting on financial events, **The Wall Street Journal Interactive Edition** (www.wsj.com), which is \$29 per year for print subscribers and \$59 per year for nonsubscribers, is tough to top. That fee buys you stories that aren't in the print edition and a lot of tomorrow's paper today, as well as e-mail notifications of particularly newsworthy events. It's not always easy to see what's new as you log on during the day, and the WSJIE

Excellent analysis and Jim Cramer make TheStreet.com a must-read.

distinguishes itself by reporting and commenting (often irreverently) on less celebrated high-tech companies that others ignore.

MSNBC (www.msnbc.com) is merely a lot of repurposed content from news wires, the WSJIE, and ZDNet. You're probably better off at MarketWatch.

CNNfn.com (www.cnnfn.com) stories tend to be news features that focus on general business trends, as opposed to reporting the fluctuations in particular

stock prices and market segments.
—Sarah L. Roberts-Witt

FINANCIAL DISCUSSION



Opinions. Everyone's got one, especially with regard to money and where to put it. Nowhere is this more perfectly illustrated than in the online financial

chat rooms and message boards that densely populate the Internet. You need to check out what the word on the Web is, not just to find companions but because a critical mass of opinion can affect the performance of a stock. At the same time, you need to be careful, because these sites are full of touts and worse, pumping or dumping on certain stocks without revealing their agenda. We looked at six financial discussion sites for this story and participated in conversations ranging from intelligent to obscene.

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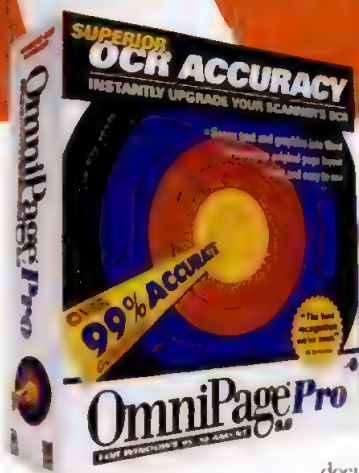
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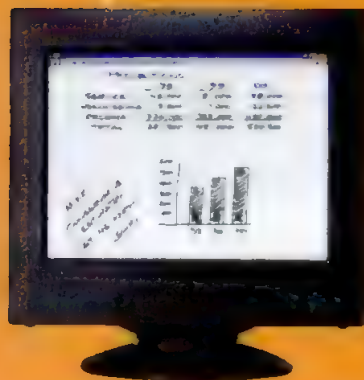




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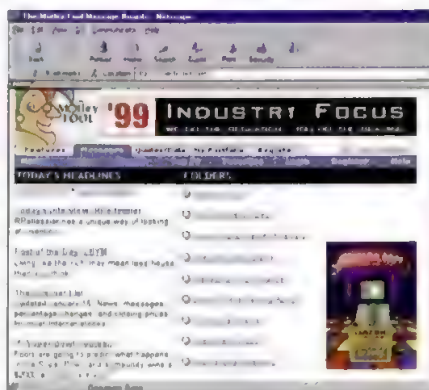
The irreverent yet friendly attitude of **The Motley Fool's** founders, brothers David and Tom Gardner, permeates this site (www.motleyfool.com). Its message boards rank low on the intimidation-and-insult scale and high for pleasantness and practicality. Motley Fool is chock-full of pragmatic, action-oriented advice on a broad range of financial topics, from capital gains taxes to investing. It should be the site of choice for regular folks.

Another top-of-the-line site is **The Raging Bull** (www.ragingbull.com). It's geared solely toward the individual investor, and its home page is populated with news stories and top posts from its hundreds of message boards. Our favorite feature is its single-company boards, which are extremely easy to find and offer instant clicks to real-time quotes, earnings charts, and posts related exclusively to each board's designated corporation.

As you might guess, **Silicon Investor** (www.siliconinvestor.com) focuses on the world of technology, both computer and biotech. For the \$120 annual subscription fee, you can access message boards and

features such as its company profiles database. Rambling through the various boards and posts to find topics in which we were interested was daunting; luckily, the site has a powerful search engine.

The tone on SI boards is pretty savvy, and a fair number of people



seem to be on and posting messages throughout the trading day. It's really worth the subscription fee only if you're a day trader, though.

As usual, **AOL** has it all. The Personal Finance channel (keyword: *Personal Finance*) boasts a boatload of investing

forums and informal chat rooms, as most others do. Its key differentiator is its slew of live scheduled chats, so you can talk with finance experts for hours.

Yahoo! Finance (quote.yahoo.com) covers all the bases with its chat room, message boards, and reams of news and corporate background data. Its finance chat room isn't our favorite, though, since the conversation

Motley Fool gives you plenty of market talk, all in a friendly environment.

often lurches between stocks-and-market talk and thinly veiled come-ons. The message boards are much more intelligent, even though their tone tends toward snipes and swipes.

Message board beachhead **Deja News** (www.dejanews.com) culls Usenet investing forums focused on futures and options, mutual funds, and stocks. We found the participants quite "flameboyant"; a rough estimate puts the numbers at one decent post for every ten. Also, beware the prolific number of posts from fledgling companies hoping to raise funds.—SLRW

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Software

SOFTWARE RETURNS TO ITS SOURCE

In the pre-Microsoft days, software and the code behind it were freely distributed.

Thanks to the Internet, open-source software is experiencing a rebirth.

This time, programmers are not the only ones taking notice. By Larry Seltzer

The Free World of Software

The open-source movement is based on the notion that hundreds or thousands of individual programmers working in tandem can produce software better and faster than a smaller, focused development team within one company.



Official Releases

Although the development of an open-source program is continual, the individual or group that is responsible for it periodically takes a snapshot of the code and distributes it as an official release. Developers of the Linux kernel recently released the long-awaited Version 2.4.18. The Linux kernel, the core component of the open-source operating system,

License

Like any other kind of software, open-source software is governed by a license. But while most software licenses tell you only how you can use a program, an open-source license ensures that you can actually alter the program by tinkering with its code, and distribute the results of your work.

The most common license is the General Public License (GPL), also known as copyleft. From a legal standpoint, it is a license that allows you to use the software, modify it, and distribute the resulting work must

also be made open-source under the GPL. The Linux operating system is protected by this kind of license.

At the opposite end of the spectrum is the BSD license, the model created initially for a version of Unix known as the Berkeley Software Distribution. Essentially, the license places no restrictions on developers. Anyone can modify the program and redistribute it for a fee without being required to give anything back. The FreeBSD operating system and Apache Web server are distributed under BSD licenses.

WWW.APACHE.ORG
WWW.LINUX.ORG
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Open-Source Software

Although no one may have heard of it, open-source software is everywhere. Projects are being developed and released at a rapid pace. Without the internet, open-source software would not exist today. Sites such as SourceForge, The Apache Group, and LinuxWorld.com are a treasure trove of open-source software. You can download source code, report bugs, submit bug fixes and patches, and participate in discussions, post messages and news items, and more.

Hackers

Most developers who work on open-source software are volunteers who hack in their spare time. Some are graduate students or hobbyists. Others are out to impress their peers with their programming prowess. Still others seek to create derivative products that they can turn around and sell. Developers may fix documented bugs, search for new bugs, add new features, or even rewrite entire portions of a program. Once they've finished a task, they return the code to the module owner, although not all licenses require this step.



Modules and

Module Owners

The first version of Linux, released in 1991, contained around 10,000 lines of code. Today, it consists of well over 1 million lines of code. To make an open-source project manageable, the author or group that oversees it usually divides it up into separate components or modules. Each module has an owner, who oversees that portion of the code. Module owners, who are volunteers, ensure that the goals for the project are being met, and they review the patches and bug fixes other developers have posted to determine which ones should be added to the code and which discarded.

1968 ARPANET, the Internet's precursor, is founded. Although ARPANET is designed to allow researchers to share code and information on projects, it also becomes a showcase for the abilities of open-source software.

1969 Ken Thompson, a researcher at Bell Labs, writes the first version of Unix, a multiuser, multitasking operating system. The Unix source code is distributed freely throughout the seventies, and it soon becomes popular at universities and research labs.

1971 Richard Stallman, a pioneer in the open-source movement, joins an MIT group devoted exclusively to free software. The developer of the first Emacs text editor,



Stallman later founds the GNU project (short for GNU's Not Unix); this leads to

the creation of a free, Linux-based operating system.

1973 Vinton Cerf and Bob Kahn from DARPA

(Defense Advanced Research Projects Agency) develops the TCP/IP protocol—which becomes the networking foundation of the Internet. A decade later, the Department of Defense christens the Internet and mandates that all computers attached to the Internet use TCP/IP.

1979 AT&T announces plans to commercialize Unix. This leads the University of California at Berkeley to create its own version of Unix, called BSD (Berkeley Software Distribu-

tions) Unix. BSD Unix is adopted by early commercial vendors such as DEC and Sun. AT&T and Sun later agree to merge their versions of Unix, prompting competitors (DEC, HP, and IBM) to form the Open Software Foundation.

• A student at the University of



California at Berkeley, Eric Allman, develops a program to route messages between computers over ARPANET. Allman later evolves the

program into sendmail. Today, more than 75 percent of Internet e-mail servers use this open-source program to deliver mail.

1983 In a reaction to the proprietary trend in software, Stallman establishes the GNU project to promote the free-software model by developing a free operating system, applications, and programming tools. More important, GNU establishes the General Public License (GPL), better known as a copyleft, which becomes the model for many open-source projects.

source software to a large extent. DNS (Domain Name System)—the system that associates names like www.pcmag.com with numerical IP addresses—and sendmail, the postal service of the Internet, are both open-source projects. Yahoo!, arguably the most successful Web site in the world, relies on an open-source OS (FreeBSD) and open-source Web server software (Apache) using an open-source scripting language (Perl) to deliver dynamic content to desktops. In fact, before Microsoft came along and created the personal computing industry, much of the world's software was passed around freely among developers.

Recently, there have been signs of a renaissance in open-source. Linux, the little

open-source operating system that could, has quietly stolen a significant chunk of the Unix market and, if it isn't threatening to derail Windows NT, is at least becoming a distraction for Microsoft. In the last year, several major software companies, including Corel, Oracle, and Sybase, have announced plans to port products to Linux (pronounced "lynn-icks"). Others, such as Netscape Communications and Sun Microsystems, have taken it a step further and adopted the open-source model for their own products.

To see what all the excitement is about, we decided to take a closer look at the open-source phenomenon and some of the products that are coming out of it, both

on the server side and the desktop. We discovered that there is still a lot of work to be done before open-source software will be ready to vie for a piece of the desktop. On the other hand, open-source software (especially Linux) is becoming a serious competitor on the back end, where power takes precedence over ease of use.

In the pages that follow, we explain how open-source stays open, identify key projects, analyze who's using this software, find out what Microsoft thinks about all this, and discuss who's making money from it. We also performed hands-on reviews of four popular Linux packages (Caldera OpenLinux 1.3, Debian GNU/Linux 2.0, Linux Slackware 3.6, and Official Red Hat

PC EDITORS' HOT LINKS

www.pcmag.com/hotlinks

More than any other type of software, open-source relies on the Internet, and vice-versa. Here are some key destinations.

► Open Source Initiative

www.opensource.org

A relative newcomer, this independent organization was created a year ago to broaden the open-source movement. Here you'll find an "official" definition of open-source software and links to important projects.

► Slashdot

www.slashdot.org

Known as "News for Nerds," Slashdot delivers a daily dose of

high-tech news on open-source software and especially Linux. Ranked as one of *PC Magazine's* top 100 sites.

► O'Reilly Open Source Center

opensource.oreilly.com

O'Reilly and Associates specializes in books about open-source software. The Open Source Center includes news and links to notable open-source projects.

► Free Software Foundation

www.fsf.org

The organization behind the GNU Project, which led to the creation of many of the leading open-source tools. The Free Software Foundation's Web site provides

information on open-source projects, documentation, and source code.

► Linux Online

www.linux.org

For information on Linux, look no further than this site. Linux Online is a repository of information on everything Linux, ranging from information on projects and various distributions to news articles.

► The Linux Kernel Archives

www.kernel.org

Serving as the official source for the Linux kernel, these archives include a vast library of Linux-related software. The first place to look for Linux downloads.

► Mozilla.org

www.mozilla.org

Home to Netscape's open-source effort, Mozilla is responsible for future developments of Communicator. The site features the source code, documentation, and

a preview release of the browser.

► The Apache Project

www.apache.org

The official site of the Apache Web Server Project. This site includes product documentation, a bug-reporting system, project-related information, and the downloadable source code.

► The Perl Institute

www.perl.org

The Perl Institute is the perfect starting point for anyone seeking information on Perl. Here you'll find links to newsgroups, mailing lists, and resources on using Perl.

► The Linux Documentation Project

metalab.unc.edu/LDP

The Documentation Project is filling in the gaps in customer support by developing an extensive database of online help, including installation and user guides, and much more.

1986 Larry Wall creates Perl (Practical Extraction and Report Language), a versatile programming language used for writing CGI (Common Gateway Interface) scripts, which are the standard means of delivering more dynamic content on the Web today.

1987 Developer Andrew Tanenbaum releases Minix, a version of Unix for the PC, Mac, Amiga, and Atari ST. It comes with complete source code.

1989 Aiming to exceed the capabilities of Minix, a young student at the University of Helsinki, Linus Torvalds, releases a new Unix variant, Linux. Three years later, Torvalds copylefts Linux. Today, there are an estimated 7



million Linux users, according to Red Hat Software.

1993 FreeBSD 1.0 is released. Based on BSD Unix, FreeBSD includes networking, virtual memory, task switching, and large filenames. The BSD license does not require developers to give anything back.

1994 Marc Ewing forms Red Hat Linux to address Linux's ease-of-use problems. Red Hat packages Linux with third-party applica-



tions, documentation, and initial technical support and sells it for about \$50. Red Hat quickly becomes the leading Linux distributor. The same year, Bryan Sparks founds Caldera with backing by former Novell CEO Ray Noorda.

1995 The Apache Group builds a new Web server, Apache, based on the National Center for Supercomputing Applications' (NCSA's) HTTPd 1.3 and a



series of patch files. The free Web server becomes one of the most popular HTTP servers.

1997 Eric S. Raymond, programmer and author of *The New Hacker's Dictionary*, delivers a paper titled "The Cathedral and the Bazaar," contrasting commercial and open-source development models, at Linux Kongres. The paper becomes the inspiration for Netscape's Mozilla.org.

1998 Netscape announces it will not only give away Communicator 5.0 but will also release its source code.

- Bruce Perens and Raymond (formerly with Debian Linux) establish the Open Source Initiative and apply for a trademark on Open-Source.

- Major software vendors, including, Computer Associates, Corel, IBM, Informix, Interbase, Oracle, and Sybase, announce plans to port their products to Linux.

- Mired in a landmark antitrust case, Microsoft issues a statement citing Linux as evidence that the company does not have a monopoly on operating systems. Shortly afterward, the Halloween documents—a series of internal Microsoft memoranda on the threats posed by open-source software and Linux—are leaked to the open-source community and posted on the Web.

- Sun Microsystems announces plans to release the source code for Java 2 (formerly known as JDK 1.2) to developers, under a modified license.

Linux 5.2), the Apache Web server, and Netscape Gecko, the engine behind the next generation of Communicator.

The open-source movement didn't get serious until the early eighties, when an MIT researcher Richard Stallman established the GNU Project to create an open, free version of Unix. (GNU stands for *GNU's Not Unix*). GNU fell short of its goals, but the project yielded a host of important tools that were later merged with Linux to produce a full-featured OS. To protect the work, Stallman founded the Free Software Foundation (www.fsf.org) and drafted the General Public License (GPL) that Linux and many other projects operate under to this day.

Eric S. Raymond, the programmer behind many prominent open-source projects, fleshed out the open-source process in a well-known essay called "The Cathedral and the Bazaar." He argued that open-source produces better software because, with so many developers working on it simultaneously, new features are implemented more quickly and bugs are tracked down more effectively. These ideas were the inspiration behind Netscape's decision to release the Communicator source code.

Although most open-source projects have loose teams of developers that oversee them, commercial software companies that distribute open-source products also contribute to the cause. Both Caldera Systems and Red Hat Software have contributed some of their work on Linux.

It all sounds too good to be true: Free

software backed by credible companies, and you get the source code, too. Of course, there's no such thing as a free lunch, and open-source still has many barriers to overcome before it can attain mainstream success.

The biggest problem is that much of today's open-source programs are hard to use. Even experienced Windows users can find themselves hamstrung when Linux fails to recognize a network interface card, or when the X Window system (the basis for the graphical user interface, or *GUI*) isn't configured properly. Another major concern, especially in the corporate space, is support. No one really owns Linux, so who's to blame if something breaks? Finally, Linux simply doesn't have the same variety of sophisticated productivity applications that Windows users enjoy. Various open-source and commercial projects are addressing all these issues, but there's still a long way to go.

Why does open-source software matter to you? While you may not have any desire to mess around with source code, there are many reasons open-source can be an advantage for users. Developers can write quick patches that solve little problems. Companies can extend the functionality of their applications to meet specific objectives. And software makers can build on the code to create and sell new products and services. Finally, from a market standpoint, the existence of open-source means more competition in the software industry, and that is a good thing for all users.



opensource.org

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RATING TOP LINUX DISTRIBUTIONS

Unlike Microsoft Windows 98 or NT, the Linux operating system is not a single product. Instead, there are many distributions on the market, and not all are created equal.

All distributions share the same Linux kernel, which includes all the core OS functions and the network stack. In addition, they all provide the standard tools such as popular system libraries, a dizzying array of applications and utilities, some printed documentation, and limited technical support. Each distribution includes an X Window system and a graphical user interface (a must for Windows users), a Web server, e-mail servers, and an FTP server. The real differences lie in installa-

tion, system configuration, support, and third-party applications.

For example, installation can be arduous and the setup process often fails to recognize hardware such as network interface cards (NICs). Aside from a handful of graphical tools, most of the system and network configuration utilities have imposing command-line interfaces and demand some expertise. Customer support—at least in the formal sense—is limited. Finally, although each distribution comes with many applications, few are as sophisticated or as easy to use as Microsoft Office, for example. Nevertheless, if you're willing to invest a little time, you can get up and running. If you are just looking to get your feet wet, Red

Hat is the best choice, largely because it has the most sophisticated setup of the group. Caldera's setup is not quite as smooth, but it includes many features that make it an attractive business solution for small to medium-size organizations.

To get an idea of how the leading Linux distributions stack up from the standpoint of a Windows user, we tested Caldera OpenLinux 1.3, Debian GNU/Linux 2.0, Linux Slackware 3.6, and the official Red Hat Linux 5.2. For a complete list of distributions, see the Linux HQ Distribution List (www.linuxhq.com/dist-index.html).

First, some general recommendations. You can either purchase any of the four distributions we look

at here on CD-ROM, for prices ranging from \$40 to \$60, or download them free. The latter option may be tempting, but our strong advice is to spend the money. You'll want the included documentation, and more important, none of the vendors will provide technical support unless you pay to play. Also, before choosing a distribution, check the vendor's hardware compatibility list (often available on the Web site) to make sure all your devices are supported.

Finally, although each distribution includes some documentation, the best source for Linux support is the Internet. A good place to start is The Linux Documentation Project (metalab.unc.edu/LDP).

CALDERA OPENLINUX 1.3

Linux is not known as a corporate OS, but Caldera is trying to change that perception. Caldera OpenLinux 1.3 (\$59 list) is the only distribution that includes a comprehensive set of business applications, including its own NetWare Client Software, a database server (Sybase ASE), and a full-featured productivity suite.

Like Red Hat (reviewed below), Caldera provides a boot disk, which makes installation easier. On the whole, Caldera's installation process is not as graphical or intuitive as Red

small and medium-size businesses right out of the box. A final advantage is that Caldera Systems offers a variety of support plans that include telephone as well as e-mail support.

Caldera OpenLinux 1.3. List price: 2-CD set, Linux kernel 2.0.36, boot disk, Getting Started Guide, 30 days technical support, \$59. Requires: 386-based PC or better, 16MB RAM, 350MB hard disk space (450MB to use extra applications). Caldera Systems Inc., Orem, UT; 888-465-4689, 801-765-4999; fax, 801-765-1313; www.calderasystems.com; ftp.caldera.com/pub; 500 at www.pcmag.com/infolink.

installed separately with Debian's dselect utility, which is notoriously difficult to use. The company says it will include a new application installer in Debian GNU/Linux 2.1.

Once you get past the installation, Debian's included X Window helps make things a little easier. This distribution's biggest selling point is an alternative package manager, Debian Package Management System, which scans new applications prior to installation and checks your existing system configuration to ensure that you have the required packages and that no currently installed applications will cause a conflict. Debian is distributed by Linux Press, along



with a 268-page user guide.
Debian GNU/Linux 2.0. Direct price: 3-CD set; Linux kernel 2.0.35; *The Debian Linux User's Guide, Second Edition*; 30 days e-mail technical support, \$38.95. Requires: 386-based PC or better, 16MB RAM (for graphical interface), 100MB hard disk space minimum (200MB recommended). Distributed by Linux Press, Penngrove, CA; 888-770-4330, 707-773-4916; fax, 707-765-1431; www.linuxpress.com; ftp.debian.org; 501 at www.pcmag.com/infolink.

LINUX SLACKWARE 3.6

Once the most popular Linux distribution, Patrick Volkerding's software has lost the market lead to the more-polished Red Hat but remains especially popular with hardcore Linux users. Like Debian,



Red Hat Package Manager (RPM), which makes it easy to install and uninstall packages—at least, by Linux standards. LISA (Linux Installation System Administration) is a graphical tool you use to configure basic network client parameters as well as other features. In practice, we wound up spending a lot of time editing configuration files manually.

One of Caldera's greatest strengths is KDE (Kool Desktop Environment), a graphical desktop environment that essentially makes Linux look and act like Windows. When you combine this with the bundled StarOffice 4.0, Star Division's clone of Microsoft Office, you have a complete solution for

Hat's, but aside from having to partition our drive using the crude fdisk utility, we found that the setup was not difficult and required little user intervention. Caldera includes

DEBIAN GNU/LINUX 2.0

Debian GNU/Linux 2.0 (\$38.95 direct) is the only major distribution that is still produced by a group of volunteer programmers. This, combined with its many powerful features, makes it a popular choice among hackers. But Windows users should steer clear of Debian.

For starters, Debian gets our vote for the most difficult installation. Although it does not come with a boot disk, you can either make one or, if your system allows, boot from the CD. The setup includes a version of fdisk (for making the required hard disk partitions) that is somewhat graphical but still not very easy to use. If you have a good handle on all the hardware inside your box and you know how to configure a network, the wizard-like install is tolerable. After completing the installation, we found that almost no applications were on the system. Applications such as the emacs text editor and the Web server must be

Linux Slackware 3.6 (\$39.95 direct) does not include a boot floppy disk. And when you're creating one from a disk image, the many choices for different hardware configurations can be daunting. We finally found a generic disk image (bare.i) that worked fine.



The Slackware distribution is not nearly as easy to use as Caldera or Red Hat. But it has some good points. When we forgot to save some settings in a config script before rebooting during installation, Slackware automatically sent e-mail to the root user describing what had happened and how to recover. It also provides a good collection of powerful configuration scripts, which perform actions that would require several commands in other distributions.

One of the best features of Slackware is that it includes an installed version of Linux complete with X Window on a CD-ROM, so if you have a system that can boot to the CD-ROM drive, you can test-drive Linux without installing anything on your hard disk. Slackware includes a conversion tool for managing RPM packages and the FVWM95 window manager. Slackware is distributed by Walnut Creek CDROM, but as we were completing this story, Volkerding launched an official Slackware Web site.

Linux Slackware 3.6. Direct price: 4-CD set, Linux kernel 2.0.36, installation guide, technical support, \$39.95. Requires: 386-based PC or better, 8MB RAM, 200MB hard disk space (500MB for complete installation). Distributed by Walnut Creek CDROM, Concord, CA; 800-786-9907, 925-674-0783; www.slackware.com; ftp.cdrom.com/pub/linux/slackware; 502 at www.pcmag.com/infolink.

OFFICIAL RED HAT LINUX 5.2



Official Red Hat Linux 5.2 (\$49.95 list) has emerged as the most important player in the Linux market, because it offers by far the most polished setup and it also has an advanced package manager. If you're trying Linux for the first time, Red Hat is the best choice.

Like Caldera, Red Hat includes a boot floppy disk. The setup process conveniently probes your hardware, making logical suggestions for installation (laptop users will appreciate the PC Card support). Red Hat also makes the choice of partitioning a little easier by providing standard Workstation and Server installations, which partition your disk and choose software automatically. (To designate

your own partitions, you can still choose the custom install.) For the actual partitioning, Red Hat gives you a more graphical tool called Disk Druid that is a major improvement over the fdisk utility included with the other distributions—although you'll still need to understand some basic concepts about partitioning and directory structures.

To make system configuration easier, Red Hat includes several tools. Xconfigurator is a wizardlike alternative to XF86Setup for configuring the X Window system. And Linuxconf makes it easier to set up networking configurations: PPP clients, DHCP, and DNS. (Unfortunately, Linuxconf is still a work in progress, so it is not very well documented.) Even better, if you use Red Hat's boot disk creation script during installation, it can store your network and XF86Config information so that you don't have to enter much of this information.



Red Hat is known for its package manager (RPM), an open-source program that is used in many other distributions as well. RPM lets you safely install and uninstall applications, avoid conflicts between programs, and even upgrade the kernel itself without having to reinstall your system software or files. **Official Red Hat Linux 5.2.** List price: 3-CD set, Linux kernel 2.0.36, boot disk, installation guide, 90 days technical support, \$49.95. Requires: 386-based PC or better, 16MB RAM, 120MB RAM (450MB for Workstation, 1.6GB for Server). Red Hat Software Inc., Durham, NC; 800-454-5502, 919-547-0012; fax, 919-941-5569; www.redhat.com; ftp.redhat.com/pub; 503 at www.pcmag.com/infolink.

HOW WE TESTED

To evaluate these four distributions of Linux, we set up a basic server on a network. First, we installed the operating system and configured our hardware, network connection, and system options. To install a network, we set up TCP/IP to support local Windows 98 workstations as well as an Internet connection. IP addresses for the local workstations were provided by a DHCP (Dynamic Host Configuration Protocol) server and resolved by a local DNS (Domain Name Service) server, both of which were running on the Linux server. Our test systems were Micron Millennia PCs each with a 200-MHz Pentium MMX chip, 64MB RAM, a 4GB hard disk, an 8X CD-ROM drives, a Diamond Stealth 3D 2000 graphics adapter with 2MB RAM, and a 3Com 3C509b EtherLink III network interface card.—LS

■ LICENSE TO DRIVE SOFTWARE DEVELOPMENT

To make sure all this development can happen without corrupting the original projects, all open-source projects are governed by licenses that lay out the rules for using, modifying, and distributing the source code. Several different licenses have evolved over the years.

The most famous open-source license is the GNU Project's General Public License (www.gnu.org). The GPL, also known as the *copyleft*, requires that the program be distributed with source code and that all derivative works must also be distributed with source code. The goal of this license is to make the program and the work built on it perpetually "free." The Linux kernel, GNU programming tools such as the C Compiler, and Samba, which makes Linux servers look like Windows NT file and print servers, are all examples of GPL software.

At the opposite extreme is the BSD license—first used for the Berkeley Software Distribution of Unix—which is the least restrictive. Under the BSD license, you can tweak the code a little, compile it, put it on a CD, and sell it for a million dollars—assuming you can find someone willing to pay for it. Purists object to the BSD license because it can let a program become fragmented as developers spin off their own proprietary versions. In practice, many developers opt to give their work back to the community anyway. Apache, BIND, and sendmail are all loosely governed by the BSD license.

Recently, some notable commercial software companies have developed their own open-source licenses. Communicator 5.0, for instance, operates under the Netscape and Mozilla Public Licenses (www.mozilla.org/NPL/). This license is based on the GPL, but it also grants special rights to Netscape and its development partners. And Sun Microsystems announced that the Java Virtual Machine would be available under Sun's Community Software License (java.sun.com/features/1998/12/source_license_QA.html). All derivative products are still required to pass Sun's compatibility tests, which carry a licensing fee.

To capitalize on the momentum generated by these announcements, last year

several prominent open-source advocates established a watchdog group, the Open Source Initiative (www.opensource.org), to legitimize open-source software and bring it into the business world. As we discuss in the following sections, there are strong indications that projects such as Linux and Apache are already starting to make that transition.

■ KEY OPEN-SOURCE PROJECTS

The most famous and controversial open-source project is undoubtedly Linux. Famous because from its humble beginnings as the pet project of a university student, it has grown to become the leading open-source operating system. And controversial because it has become a focal point for those seeking to break Microsoft.

The root of Linux was a scaled-down version of Unix known as Minix. In 1991, a Finnish student, Linus Torvalds, modified Minix, adding task switching, basic hardware support, and a file system. Torvalds posted his creation on an FTP server and invited programmers to try it for themselves. Today, more than 1,000 developers contribute to the Linux kernel (www.kernel.org), which encompasses all the core OS features, the file system, and the network stack. And the project has grown so large that major areas of work have their own "lieutenants."

Linux has rapidly grown into a formidable competitor that runs on all major processors (x86, Alpha, MIPS, PowerPC, and Sun SPARC) and supports multiple users, multitasking, virtual memory, and TCP/IP networking. As we were completing our story, Torvalds released the long-awaited Version 2.2.0 kernel, which adds support for some 64-bit platforms, limited ability to read and write Windows 98 and NT file systems, enhanced support for SCSI devices and network interface cards, and new multimedia features.

Many of the programs included in a Linux distribution are also open-source projects, including the GNU Project's developer tools and applications, as well as the Xfree86 server, the platform for a GUI. Another program included with most distributions, the Apache Web server, is probably the most successful open-source ven-

ture to date. More than half of the domain names on the Web are handled by Apache, according to Netcraft's Web Server Survey (www.netcraft.com/survey), making it far more prevalent than competitive products from Microsoft and Netscape.

Apache was born in 1995 when a small group of developers consolidated a series of patches they had made to the National Center for Supercomputing Application's (NCSA's) HTTP daemon (the name is a play on "A Patchy Server"). A year later,

Apache was the most popular server on the Web. Currently, a team of about 20 developers, known as the *core*, coordinates the Apache project (www.apache.org). Recently, IBM announced it would use the Web server in its WebSphere application server for e-commerce applications, lending some of Big Blue's corporate credibility to the open-source project.

Although it has less visibility, Perl has also become a major open-source success. Known as "the duct tape of the Web," Perl

THE BASICS OF A LINUX DISTRIBUTION

Although the essence of Linux is the kernel, it takes much more to make a complete operating environment. Here are some of the key elements of a typical Linux distribution.

Boot manager The boot manager is a utility that resides in the master boot record (MBR), which is loaded by your computer's BIOS at startup. If you add Linux to a system with Windows or other OSs, the boot manager lets you select which OS you'd like to run. Although there are third-party boot managers such as V Communications' System Commander, Linux includes its own boot manager, known as LILO (Linux LOader), which is usually installed by default.

User interface At its core, Linux is a derivative of Unix, and its default interface is a DOS-like command line. To make Linux more accessible, there are several graphical desktop environments that make Linux look and feel more like Windows or Macintosh OSs. Examples include CDE (Common Desktop Environment), KDE (Kool Desktop Environment), and GNOME (GNU Network Object Model Environment).

X Window system Like Windows' GDI (Graphics Device Interface), X Window is

the graphics subsystem that supports a graphical user interface. One of the most common X servers is Xfree86 (www.xfree86.org). During setup, you can choose whether to install an X Window system.

Internet services Linux has native support for TCP/IP and all common Internet protocols, including DNS (Domain Name Service), HTTP (Web server), SMTP (e-mail), FTP (File Transfer Protocol), NNTP (news), and PPP/SLIP (for dial-in accounts). Most distributions include Apache, the popular open-source Web server, as well as Web browsers, e-mail clients, news readers, and other Internet applications.

File and print services These services allow a system to access network resources and share files and printers with other users. Typical services include NFS (Network File System) for sharing files with other Unix-based systems; Samba, which makes Linux systems look and act like Windows NT servers; and AppleTalk.

Applications Linux does not yet enjoy the same widespread application support that Windows does. But most distributions bundle literally hundreds of applications, and if you're willing to look, you'll

find a good variety of tools elsewhere. In addition to basic text editors such as Crisp and XEmacs, there are several productivity applications and suites. GIMP (GNU Image Manipulation Program) is an Adobe Photoshop clone.

Package managers Package managers are tools designed to install, uninstall, and upgrade applications on a Linux system. The Debian Package Management System and Red Hat Package Manager (RPM) are well-known package managers.

Developer tools Since Linux is a favorite of programmers, it is not surprising that distributions include many developer tools. These include utilities for managing and building programs from source code, debuggers such as gdb, compilers such as egcs and gcc, programming languages, and scripting languages such as Python and TCL.

Libraries Linux includes a core set of library routines (libc). Like the dynamic link libraries (DLLs) found in Windows, libcs are executable modules that perform behind-the-scenes functions that support other applications. Most distributions include many libraries; common types include GNU Libc (glibc) and Libc5.

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HOW TO INSTALL

L I N U X

■ A step-by-step guide for Windows users

Linux has come a long way, but don't expect the installation to go as smoothly as your upgrade to Windows 98. To get it right, you'll need to do a little research and take some preliminary steps to prepare your system to run multiple operating systems. For complete details, read the documentation that is included with your distribution and The Linux Documentation Project at <http://metalab.unc.edu/LDP>.

1

Before You Begin

A. Collect System Information Although Linux can automatically recognize many hardware devices, it is hardly foolproof. To complete your installation, you may need to enter information manually, so the first step is to collect all the information on your hardware devices (make and model numbers) and their configurations. If you're using Windows 95, 98, or NT, the easiest way to do this is to print the information from the **Device Manager** tab in the System Properties dialog box (Control Panel | System).



B. Create a Boot Disk The simplest way to install Linux is to boot directly to the distribution CD-ROM, but only a handful of new PCs allow bootable CD drives (you can check this in your system's BIOS settings). Most users will need to boot from a floppy disk. Caldera OpenLinux 1.3 and Red Hat Software's RedHat 5.2 include boot disks, but most distributions require you to create your own boot disk using an included utility such as Rawwrite.

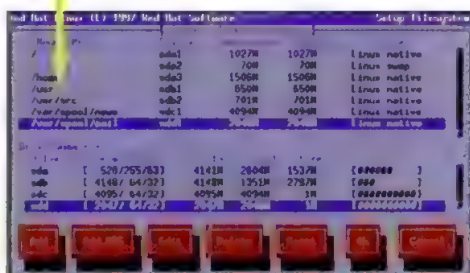
C. Create Room on Your Hard Disk Because of the many bundled applications, the size of a typical Linux workstation installation varies widely, from about 100MB to 500MB or more. Linux must be installed on its own partition. If you have only one partition, devoted to Windows, you'll need to create some space for additional partitions. First, make a backup of your existing system and run the Windows disk defragmentor to place all existing data in one area of your drive. To resize your current partition, you can use a DOS utility called FIPS or a third-party tool such as PowerQuest Corp.'s PartitionMagic 4.0 or V Communications' Partition Commander.

2

Installation

A. Options for Installation There are a variety of ways you can install Linux, including from your hard disk, a shared disk, or a CD-ROM. Installing from a CD-ROM is probably the most convenient. As your system boots, Linux will attempt to detect your hardware. If it fails to recognize your hardware correctly, you'll have to tell Linux about your devices by entering the information by hand. The actual installation program should be a step-by-step, interactive process similar to that of Windows, although less graphical.

B. Create and Edit Partition Tables During installation, you will have to edit the new partitions you've created. To do so, you'll need a utility such as the included fdisk (which is not the same as DOS's fdisk), cfdisk, or Red Hat's Disk Druid. Now you'll need to create at least two partitions: a root partition that contains the Linux kernel (the core components of the operating system) and a swap partition that Linux will use for virtual memory—an extension of your system's RAM. Many users also create separate partitions to hold applications and home directories.



C. Configuring the GUI Although Unix experts can get along just fine in a command line world, you'll probably want to install a graphical user interface (GUI) to make Linux a little more user-friendly. There are several graphical environments to choose from, but all of them require a basic platform called the X Server. The most common X Server is called Xfree86. During installation, choose the option to install an X Server. To configure it, you may need to enter some detailed information about your mouse, graphics adapter, and monitor, including the monitor's scan interval and refresh rate. Be sure to enter this information correctly. The wrong settings can damage your hardware.

D. The Final Steps At this point, the actual installation should take place. Once completed, the setup takes you through a series of menus that will help you to configure your system. Since you'll be running both Windows and Linux, you should opt to install LILO (Linux LOader), a multiboot utility for Linux systems.

3

Running Linux for the First Time

A. Log-On When you first boot your system, you'll be prompted for a log-on ID. You'll want to log on as "root." If you are using LILO, you may have to hold down a key, such as the Ctrl key, during boot to access a boot prompt where you can choose which OS to load.

B. System Configuration After installation is complete and you have booted for the first time, you might have to perform basic administration and configuration tasks. These can include setting up a host-name, reconfiguring the X Server to meet your needs, or configuring LILO to handle all of your operating systems properly.—Matthew Graven

NETSCAPE JUMPS ON THE BANDWAGON

In a sense, Netscape Communications built its Internet empire on free software, transforming NCSA's Mosaic browser into the hugely popular Navigator and later the Communicator suite. Nevertheless, observers were shocked when, a year ago, Netscape suddenly announced that it would release the source code for Communicator 5.0.

At the time, Netscape's share of the browser market was withering under a relentless assault by Microsoft. So the move was perhaps in some measure a marketing ploy designed to ally the company with an increasingly popular (anti-Microsoft) movement. But it also marked the first time a major software company had opted to give away the code to one of the world's most popular applications. From an end user's standpoint, the new development effort, managed by the semi-independent Mozilla.org, promises to bring some significant changes in the Communicator suite.

Like a restored vintage auto, Communicator 4.5 looks great on the outside, but its engine is sorely out of date. The next version of Communicator will be built on an entirely new HTML engine. This overhaul will offer several advantages.

First, the browser should be significantly faster. For example, Netscape claims that the new engine renders HTML tables up to 20 times as fast as earlier versions. We took a look at an

early preview version of the engine, code-named Gecko, and it does indeed appear to be noticeably faster than Communicator 4.5, even when loading pages stored locally.

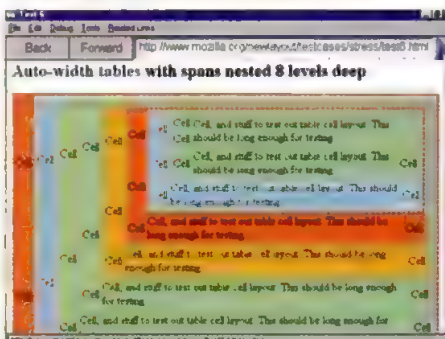
Second, Communicator 5.0 should be more standards-compliant. This will be a big improvement for Web page designers, who often have to create two versions of each page because of different implementations of standards such as Dynamic HTML (DHTML). Netscape promises full support for XML and Cascading Style Sheets (Level 1).

Finally, Communicator 5.0 will have a more modular architecture. That means customers can download only what they need—a lightweight browser, for example. More important, the "componentization" of Communicator is also part of a strategy to make it more attractive to other technology companies as a platform. In this area, Netscape is playing catch-up with Microsoft, which introduced a component-based architecture as early as Internet Explorer 3.0, and has been reaping the benefits. Even America Online, which now owns Netscape, uses IE as the browsing platform in its client software.

To ensure that Communicator 5.0 would be an attractive platform for other software companies, Netscape wrote its own licenses for the Mozilla source code. Unlike the GPL license, the Net-

scape/Mozilla Public Licenses let other companies modify and redistribute Communicator without releasing the code for their derivative works.

Of course, Microsoft is not resting on its laurels. A beta version of Internet Explorer 5.0 has already been released. It includes a long list of usability enhancements, including better



Gecko displays HTML tables faster.

management of Favorites, improved off-line browsing, and more powerful search features.

If you're really adventurous, you can download early versions of both IE5 (windowsupdate.microsoft.com) and Netscape Gecko (developer.netscape.com/software/communicator/ngl/index.html). But it shouldn't be long until the real programs arrive.—MG

is a scripting language that was created in 1987 by developer Larry Wall. A versatile tool, Perl can manipulate text strings, automate tasks, and connect seemingly incompatible programs. Because of its text-handling strengths, Perl is primarily used on the Web to create HTML on the fly.

Perl is currently in its second iteration. Development is managed by The Perl Institute (www.perl.org), which maintains message boards and a compilation of new patches. According to the institute, there are over 1 million Perl users worldwide.

■ OPEN-SOURCE MEANS BUSINESS

Despite the success of projects such as Linux, Apache, and Perl, open-source software has had a hard time gaining entrée into corporate America. Often system administrators and programmers have had to sneak Linux in through the backdoor. In the past year, however, Linux has cast off that role and emerged as a legitimate business solution. While there's still a

lot of work to be done before it can compete for the desktop, Linux is making major inroads as a server operating system.

Last year, Linux was the fastest growing server operating system, according to a recent study by International Data Corp. Although Windows NT Server and NetWare still have larger shares of the mar-

ket, Linux shipments grew by more than 212 percent, giving it 17 percent of the market, or about the same as all other flavors of Unix combined.

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There are several reasons for Linux's growing popularity as a server OS: (1) it is a true multiuser, multitasking OS, (2) it is perceived as reliable and scalable, (3) it works on a wide range of hardware and runs comfortably on a 486 with 8MB of RAM, (4) it supports virtually all standard networking and Internet protocols, (5) it is

readily customizable, thanks to its open nature and a wealth of developer tools, and (6) you can't beat the price. The latest official release of the kernel, Version 2.2.0, adds a critical component: support for symmetric multiprocessing (SMP). These strengths are helping Linux find new roles in business. In larger organizations, Linux is emerging as a popular "single-function" server. For example, Cisco Systems uses Linux to run its major print servers, and Sony Worldwide serves up Web pages on an intranet using Linux and Apache. At the same time, leading Linux distributors such as Caldera Systems and Red Hat Software are positioning Linux as a turnkey solution for small to medium-size businesses that want to set up networks and run their own Web sites. Of course, Linux's success among ISPs is well known.

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On the client side, Linux is not as well positioned to grab market share from Microsoft, largely because it is still too difficult to use. Nearly all open-source products were created by programmers to "scratch an itch"—that is, to address particular problems. Consequently, there was not much concern for how others, especially end users, might use a given program. Unix users will feel right at home in Linux, but even advanced Windows users will find it daunting at first. The rest should steer clear until Linux gets an easier install, solid hardware support, a consistent GUI, and more third-party productivity applications.

Several groups are currently developing GUIs that make Linux look more like Windows or the Mac OS. The leading candidate is KDE (Kool Desktop Environment), a graphical desktop environment, bundled with Caldera OpenLinux. KDE (www.kde.org) makes Linux look and act like Windows. GNOME (GNU Network Object Model Environment) is a more ambitious project led by Red Hat Software to create a graphical environment using CORBA (www.gnome.org).

Perhaps the most significant recent advance has been the expansion of applications support. Corel recently released a version of WordPerfect for Linux, and several companies including Applix and Star Division have developed integrated office suites that offer functionality similar to Microsoft Office and even support Office file formats. Meanwhile, IBM, Informix, Sybase, and Oracle are all porting database products to Linux.

To present a real challenge to Microsoft's mainstream operating system, Linux must make more concessions to the typical user. But as a server operating system, Linux has what it takes to compete with Unix and Microsoft Windows NT.

■ OPEN-SOURCE VS. GOLIATH

There is little chance that Linux will knock Windows 95 or 98 off your desktop anytime soon. Microsoft maintains a comfortable lead on the client side, because no other x86 operating system can match its breadth of applications or ease of use. But on the back end, the picture is less clear. Windows 2000, Microsoft's answer for enterprise computing, has been delayed repeatedly, and there's still

no certainty that the OS can deliver the goods. Meanwhile, Linux is shaping up to be a real player in the server operating system market, posing a new threat to the monolith's market dominance. While we don't expect Microsoft to join the open-source movement, you can bet that the phenomenon is on Redmond's radar.

Although describing Microsoft as "a better imitator than innovator" is overstating the case, the company nonetheless has a record of quickly adapting to new competition—as it ably demonstrated in 1995, when Netscape Navigator became a threat. Microsoft's competitors now see Linux as a way to break the Wintel bloc, and many are planning to support Linux with future releases. Nevertheless, Microsoft doesn't

yet see the same threat in Linux that it did in Netscape's Internet products.

One reason is that Microsoft thinks the hype greatly exceeds Linux's actual presence in the marketplace. There is no doubt the Linux market is growing: Red Hat estimates there are 5 to 10 million users. But that still represents only a fraction of the total number of operating systems shipped on new PCs—95 percent of which will be Windows this year, according to Dataquest. Microsoft also argues that Linux is growing at the expense of Unix, not Windows NT, and there is some data to support this assertion. Furthermore, as Microsoft points out, Linux's success is tough to gauge because users may be downloading the OS but not adopting it.

A P A C H E RULES THE WEB

No program has done more to dispel the notion that open-source can't survive in the real world than the Web server Apache. More than half of the domain names on the Web are served up by Apache, according to Netcraft's survey of some 4 million sites. Apache's closest competitor, Microsoft Internet Information Server (IIS), handles only about half as many sites. When you look at what Apache offers, you can easily see why it enjoys such success.

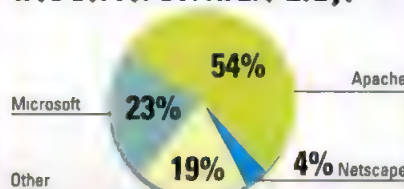
Because Apache is an open-source program, loosely governed by the anything-goes BSD license, developers are free to do what they please with it. This freedom, along with some other developments, has made Apache ideal for ISPs, which typically have the in-house expertise to take advantage of the flexibility.

With Apache, Webmasters can add their own extensions and compile these changes right into the Web server. An Apache module called Mod_perl is a good example. Many sites use CGI (Common Gateway Interface) scripts written in Perl to deliver dynamic content on Web pages. Mod_perl embeds a Perl interpreter in Apache, which speeds up scripts and lets Webmasters extend the functionality of the server.

IIS provides similar capabilities using a feature called Active Scripting. By using COM interfaces, you can plug various scripting engines into the Web server. Although these engines are not compiled into the server, they do run in the same process space as the Web server, so they provide many of the same advantages. JavaScript and VBScript are the default scripting engines; others are available from third parties.

The most conspicuous difference between the products has to do with day-to-day administration. Administrators can configure virtually any aspect of Apache—short of recompiling it—and send a signal to the server to reload all of its components on the fly. In order to do this, the Apache administrator must modify a series of configuration files. Whereas IIS servers currently offer a graphical interface for configuration,

Web Server Software Usage



Source: NetCraft Web Server Survey, January 1999

Apache's graphical module is still in the works. It's based on Linuxconf, the popular configuration tool for Linux (www.solucorp.qc.ca/linuxconf), and should alleviate this problem. Other groups have similar efforts underway.

Both Apache and IIS have scored deals with some of the biggest sites on the Web. Sites such as Yahoo!, GeoCities, the W3 Consortium, and (oddly enough) Microsoft HotMail all entrust their servers to Apache, while IIS keeps Dell, eBay, Onsale, and 1-800-Flowers in business.

For some users, IIS strikes a fine balance between power and usability. But many Webmasters want all the power and configurability that Apache delivers. Clearly, the market is big enough for both.—LS

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Linux loyalists often claim that the OS is technically superior, boasting of its bullet-proof reliability. Microsoft counters that Linux has not been truly tested in the enterprise. For that matter, Windows NT still has a lot to prove in the enterprise, so there is little empirical evidence to support either side on this score. Windows has an obvious lead in usability, though: Even Linux vendors concede that developers have paid little heed to ease-of-use issues in Linux.

Other barriers to Linux have to do with the perceived limitations of the open-

source software in general. Microsoft made headlines when a series of controversial memos on open-source and Linux, written by one of its engineers, were leaked to the open-source community in the last week of October—earning them the nickname “the Halloween documents” (www.opensource.org/halloween.html). Officially, Microsoft acknowledges only that Linux is a legitimate contender for specific markets such as general-purpose servers and small to medium-size ISPs.

Although the company remains skep-

dows anytime soon, nor force Microsoft to rethink the way it does business. But whether Linux can beat Microsoft is not the real question. It is not just conceivable but likely that Linux will continue to win converts and evolve into a more mainstream OS, even as Microsoft maintains its grip on the desktop. The many companies that are already thriving by selling software and services based on Linux and other open-source projects attest to this.

Linux will continue to win converts and evolve into a more mainstream OS, even as Microsoft maintains its grip on the desktop.

source model. Microsoft points out that as the operating system becomes more mainstream, developers will be hesitant to give away their expertise. When you add to this the customer-support issues, the odds of Linux's breaking out seem long.

This does not mean that Microsoft isn't paying attention to Linux and to open-

tical of the open-source model, Microsoft has distributed source code for some of its products in certain cases. For instance, Microsoft has released portions of the code for Windows and Windows NT under nondisclosure agreements to various commercial and research entities.

Linux is not going to overtake Win-

■ THE PLAYERS TO BET ON FOR OPEN-SOURCE

One of the strangest lessons of the Internet era is that the fastest way to make money is to give your products away. The open-source movement takes this a step further by giving away the code behind the products. That's as if Coca-Cola not only gave away its soft drinks but also distributed the secret recipes and let people use them to make their own colas. All of which begs the question, just how are companies going to grow their business on open-source software?

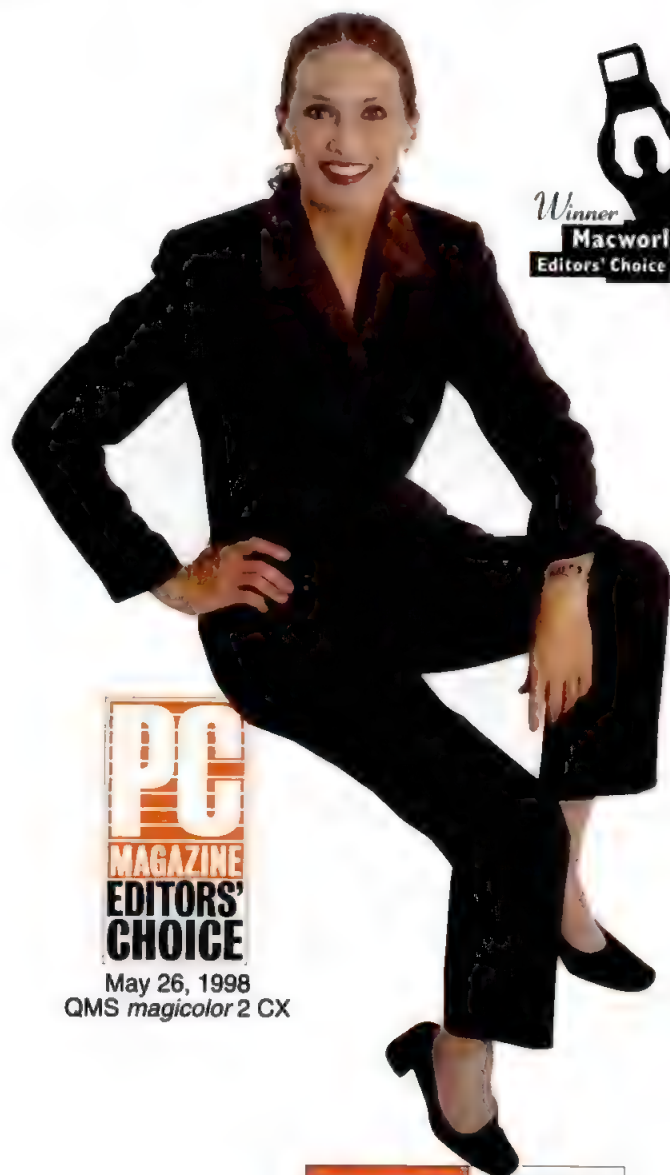


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SOFTWARE
Open Source

Perhaps the most familiar model for making money with free software is to brand it and distribute it with other products and services. Caldera Systems (www.calderasystems.com) and Red Hat Software (www.redhat.com) are popular examples. Both companies have built businesses around the free Linux kernel by adding features that make it easier to use and more capable, and then providing reliable distribution and offering technical support.

Both Caldera and Red Hat also sell Linux training courses. Aside from that, Red Hat recently announced a certification program, and Caldera sells commercial software for Linux, such as NetWare for Linux (starting at \$59 for a three-user license).

Another formula is to give away a product and its source code as a way to expand market share and promote related products and services. This is essentially the business model behind Microsoft Internet Explorer and Netscape Communicator, both of which can be freely downloaded and distributed. Netscape has taken it a giant leap further with Mozilla.

Aside from producing a faster, more reliable browser, Netscape hopes the move will promote its other businesses, such as the server software and Netcenter portal. Sendmail Inc., the corporate offspring of the highly successful mail-transfer agent called sendmail, continues to enhance the open-source product while also developing commercial versions such as Sendmail Pro.

interfaces for Web server administration.

VA Research takes the headaches out of installing and configuring Linux by selling preconfigured workstations, servers, and notebooks, starting at around \$1,400. Even major PC vendors such as Compaq, Dell, Gateway, and Hewlett-Packard have announced plans to sell Linux servers. As the installed base of Linux broadens, other

**The most common model for making money
with free software is by branding it for
distribution with other products and services.**

Hardware makers can also benefit by leveraging the strengths of open-source operating systems to create new devices. One example is the Web server appliance, a turnkey server for small businesses or workgroups. The Cobalt Qube, Corel NetWinder (soon to be acquired by Hardware Canada Computing), and Whistle Communications InterJet are all vying for a piece of this market. These products add value by masking the powerful features of Linux and FreeBSD behind browser-based

companies are stepping in to provide customer support. LinuxCare (www.linuxcare.com), for example, provides support for Caldera, Debian, Pacific HiTech, Red Hat, Slackware, and SuSE Linux distributions.

As more and more companies join the open-source movement, the hardware, software, and support options will rapidly multiply. Once that occurs, open-source software will be a viable alternative—and one that all businesses should consider. **PC**

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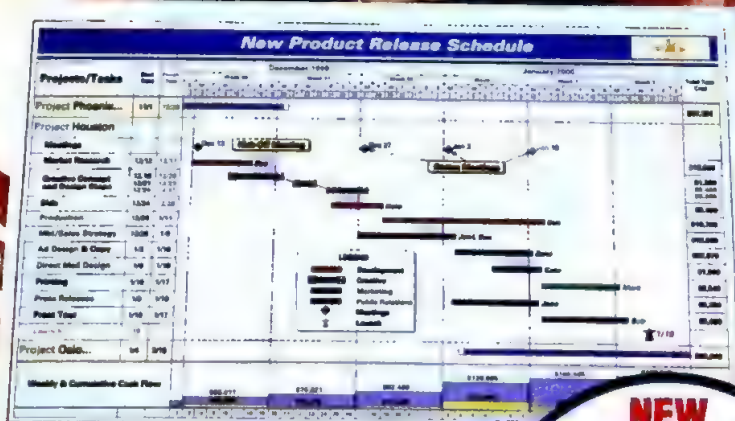
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TUTOR

Windows File Types



Understanding how Windows handles file formats and associations can put you in the driver's seat.

By Neil Randall

We use files every day, and for most of us, the quickest way to get at those files is by clicking on them in Windows Explorer. But what do you do when Explorer won't open a file? We'll show you why that happens and what to do about it, and we'll also take a look at some file types that are either new or increasingly popular on Windows systems and on the Internet.

When you open a folder using Windows Explorer, you see a variety of icons beside the filenames. You may see that each filename ends with a period followed by one or more characters. This is called the file *extension*. Anyone who used PCs before the introduction of Windows 95 will recognize these extensions, which date from the days of DOS, and will also recognize the icons as one of the core components of the graphical user interface. The extension and the icon work together to show you the type of the file and the application that uses that type of file.

FILE FORMATS

As far as the operating system is concerned, a file is simply a series of bytes, but how those bytes are interpreted depends on the file's format and the application reading it. Every file format specifies a system of encoding and organizing data that a specific application has been designed to use. (For a more detailed explanation, see "A Look Inside Bitmap Files," www.zdnet.com/pcmag/issues/1521/pcmg0038.htm.) A MIDI file, for example, contains information pertaining to music (tone, volume, tempo, and so forth) that the MIDI application follows to create a song. A database file consists of data records and information on how those records are structured. To a different program, this data is gibberish, and often the application will simply display an error message and refuse to load the file. If you do manage to load an unsupported file, it might appear on the screen as unformatted text or as junk, or it might even crash the application and perhaps the operating system as well.

Usually an application works best with files created in the application's native format, the file format specific to the application itself (though many programs are also capable of reading some other kinds of files). A file created in WordPerfect 8.0, for example, contains not only the text typed by the author but also formatting codes for elements such as fonts, margins, tables, graphics, and styles, specified during the document's creation. Word 2.0 can't follow the WordPerfect 8.0 formatting instructions and thus will load the file as gibberish, if at all. Word 97 and 2000 will load the file by converting it from WordPerfect format into Word format using a conversion utility built into the application.

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USER TO USER



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Page 191.

UTILITIES



Reloader lets you define sets of programs to load together. You can start Windows with the same programs that were running when you last shut down or with the same programs each time, or you can load predefined sets of programs on demand. **Reloader** also attempts to restore each program to the same state and position you specified. Page 203.

PC TECH



Microsoft Windows CE isn't a stripped-down version of Windows 9x or Windows NT; it's a totally new Windows version designed for small battery-powered devices. We look at what makes the OS unique, the variety of tools available for writing Windows CE applications, and some of the subtle differences you'll encounter in coding for Windows CE compared with its bigger siblings. Page 205.

SOLUTIONS TUTOR

Every file format is identified by an extension added onto the file's name. DOS systems use extensions with up to three letters, but other systems—including Windows 95 and 98, Windows NT and 2000, the Macintosh, and Unix—allow longer extensions. As an example, Web designers working in Windows 3.x have always had to save their HTML documents with a three-letter .htm extension, while the standard for Unix (and hence for the Web) is the four-letter .html. In the operating system, file extensions are associated with applications that can work with them, so that double-clicking on a file

see the extension (or extensions) used with that file type and the program associated with that extension. The program and its associated icon are shown beside the field *Opens with*, and this means that if you double-click on a file of that type from any folder or from the desktop, the application will launch and automatically open the file with it.

Most applications automatically register their file types and associated file extensions upon installation. Some extensions have no associated applications, though; if you attempt to launch one of these file types from Windows Explorer, you'll be presented with the *Open With* dialog, in which you can select an application to display that file. Of course, if you choose an application that can't decipher the specified file's format, the best you can expect is that the file won't be loaded. The worst is that you could crash your system.

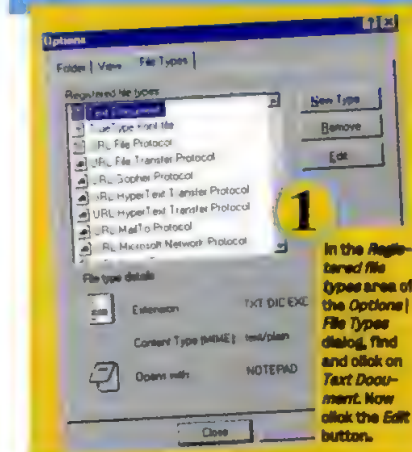
Windows stores file association information in the registry, but we don't recommend editing these

type, and double-click on it to associate the application with that file type. When the *Edit* dialog closes, you'll see the new program icon beside the *Opens with* field. You can test what you've done by finding a file of that type, double-clicking on it, and making sure the associated application launches.

For example, let's say you often work with large ASCII text files (those with a .txt extension) and when you launch them, you always get the dialog telling you that a file is too big for Notepad and asking whether you want to open it in WordPad instead. To prevent this from happening anymore, you decide to have WordPad open TXT files by default. In the *Registered file types* area of the *Options | File Types* dialog, find and click on the entry called *Text Document*, which Windows associated with Notepad during installation. Click the *Edit* button, then highlight the *Open* action and click the *Edit* button from this dialog. In the subsequent *Editing action* dialog, click *Browse*, move to your Windows directory, and double-click on the file *Write.exe*. Click *OK* until you're back to the *Folder Options* dialog and you'll see in the *File type de-*

Freedom of Association

Most Windows systems associate files with the .txt extension with Notepad by default. If you work with many large TXT files, you'll often get an error message saying that a file is too big for Notepad and asking whether you want to open it in WordPad instead. You can cut out this step by associating the file type with WordPad.



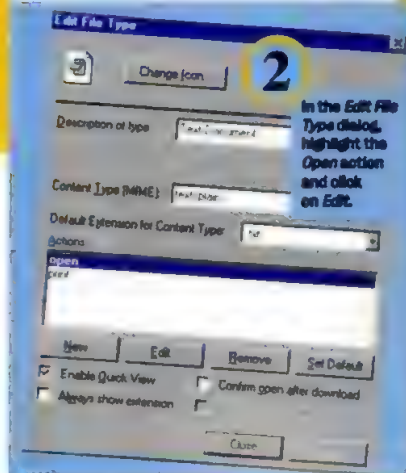
1 In the *Registered file types* area of the *Options | File Types* dialog, find and click on *Text Document*. Now click the *Edit* button.

icon causes the file to be loaded into the correct application.

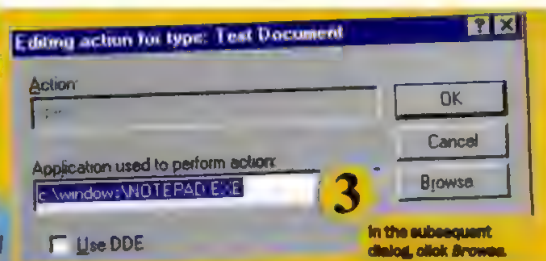
ASSOCIATING FILES WITH APPLICATIONS

Let's start by making sure Windows displays the extensions. To do this, open Windows Explorer and select *Options* from the *View* menu. Click the *View* tab, then uncheck the item called *Hide file extensions for known file types*. Click *OK*, then go into a folder and look at the file types. Each file will now display both its extension and its associated icon.

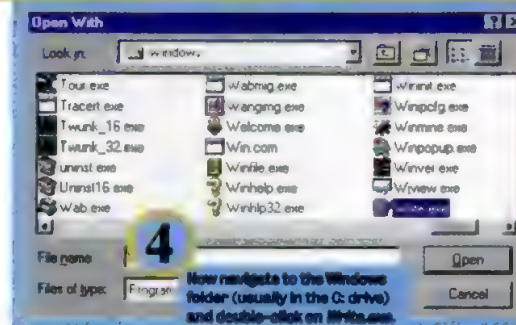
You can view your system's registered file types, extensions, and program associations with Windows Explorer. Choose *View | Options* (or *View | Folder Options*) from the main menu. In the *Options* window, click on the *File Types* tab (see illustration) and select one of the file types listed in the *Registered file types* window. In the *File type details* area in the bottom portion of the window, you will



2 In the *Edit File Type* dialog, highlight the *Open* action and click on *Edit*.



3 In the subsequent dialog, click *Browse*.



4 Now navigate to the Windows folder (usually in the C: drive) and double-click on *Write.exe*.

tails area that you've made the change. Now find a TXT file, double-click on it, and watch it load into WordPad.

A FEW SAMPLE FILE FORMATS

Most of us are familiar with the file formats we use every day, typically those associated with the office suite applications that came on our machines. But with the ever-increasing popularity of the Web, we're encountering new file types all the time. The Web consists of downloadable files viewable within a client application known as a browser. From the

beginning, browsers could display HTML and text files. Soon afterward, they could display graphics files in the JPEG and GIF formats, and they could play sound files in the AU format (Sun's audio scheme). More file types have been added since, including ASP (Active Server Pages) and CDF (Channel Definition Format) for Internet Explorer. But through the use of add-

Through the use of add-on programs, or plug-ins, browsers can handle even more file types.

on programs, frequently called *plug-ins*, browsers can handle even more file types than this. Clicking on a hyperlink will load the program associated with that file or in some cases launch the program within the browser window itself. Let's take a look at some of the common file types found on the Web.

HyperText Markup Language (HTML) is the original and the most common file type on the Web. The format includes the textual content of the file, the style formatting for that content, information about hyperlinks to files both inside and outside the machine or network on which the file resides, and information about the processing of the file. In addition, the format allows the embedding of

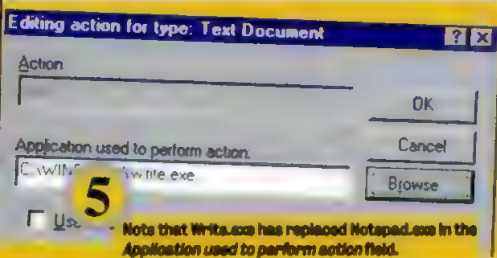
only to the degree that no loss of data takes place. JPEG, on the other hand, is a *lossy* compression technique, where the file is divided into squares and repetitious data is discarded. Users can specify the degree of JPEG compression (not the case with GIF), to the extent that heavily compressed images will show the loss of data quite clearly. The ad-

vantage, though, is smaller graphics that will load more quickly.

MPEG (Motion Picture Experts Group) technology offers a coding mechanism for video and audio, in files with extensions .mpg, .mpeg, and .mp3. Different applications of the technology require various specifications; MPEG specifications range from 1 to 7. MPEG's claim to fame is its use of sophisticated algorithms that maintain sound and picture quality while allowing substantial compression.

MP3 has captured significant headlines recently. Some in the music industry see MP3 as a threat to profits. Users can download songs, play them on their computers, and, because of the songs' relatively small size, store large collections of tracks on hard disks or on writable CDs. Some MP3 software lets you create MP3 files from your existing CD collection, which essentially means that the illegal taping problem that once reputedly plagued the recording industry now takes on a different form. Companies such as Diamond Multimedia and Samsung are even offering portable MP3 players, which typically offer enough RAM to store up to an hour of music or so. And sites such as www.mp3.com already provide a wide range of MP3 downloads, with links to CD purchase sites.

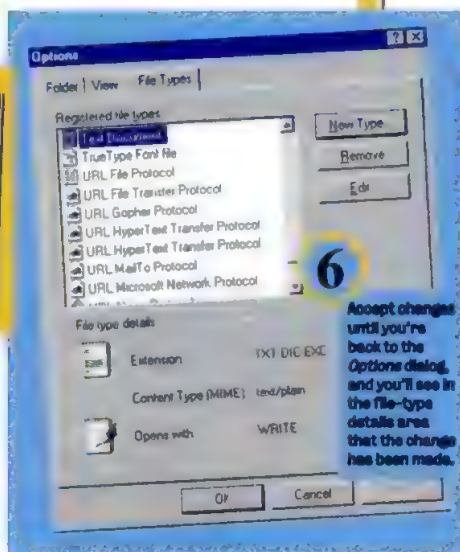
The family of file formats created by RealNetworks—including RA, RAM, RM, and RMM—began with the sound format called *RealAudio*, but the company now offers video as well. These formats represent a



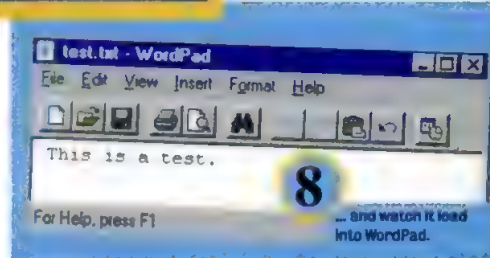
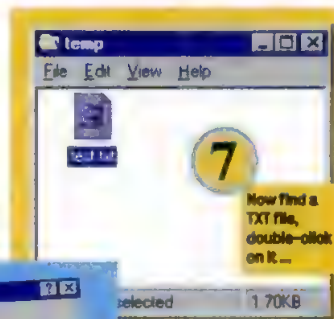
other types of files, such as Java scripts.

Waveform Audio (WAV) and **Sun Audio (AU)** are audio file formats that are old standards on the Net, although AU files were widespread mostly in the early days; as Windows users started to come aboard in droves, the Windows-native WAV files came to the fore. Both formats define such elements as a play list, ordering of sound data, cueing points for the data, and data labels.

Introduced by CompuServe, **GIF (Graphics Interchange Format)** has served as one of the two primary graphics formats since HTML first allowed the inclusion of graphics. The other is **JPEG** (for *Joint Picture Experts Group*). Both represent file formats with structures specified for components, density, storage, and other attributes of the graphic, but they also represent types of compression. GIF is a *lossless* compression technique, which means that the graphic is compressed



The various layers of the MPEG-1 specification define the degree of quality of sound in the file, and also the degree of compression. Layer 3 (with the extension .mp3) offers near-CD sound quality at a compression ratio ranging from 12:1 to 24:1. The compression makes the files small enough that they can realistically be downloaded by modem. A 4-minute song can be compressed into a file of about 4MB, as compared with three times that size for a Windows WAV file. In general, a compressed MP3 file will use about 1MB per minute of music.



set of *streaming* technologies: Instead of requiring the user to download an entire file before it can be played, the file plays as it downloads. The result is sometimes a choppy viewing and listening experience, since the stream depends entirely on the current conditions of the various networks through which the data must pass, but for many users it's far preferable to a lengthy wait.

The technology works quite well for live radio broadcasts, and also for sampling songs or videos. With high-speed Net connections, RealNetworks' streaming technology comes into its own to deliver sound approaching CD quality and video without the many stalls and bumps. Microsoft offers a version of streaming technology called *Active Streaming Format (ASF)*, designed to be used in conjunction with NetShow, a client that ships with Windows.

If you head for Microsoft's home page and

examine the location field in your browser, you'll find that the home document has an .asp extension rather than the usual .htm or .html. This document uses Microsoft's Active Server Pages technology, which combines the usual Web coding with scripting and programming. ASP provides a relatively unified way for developers to add interactivity in the form of scripts and database connectivity to their pages.

Adobe's *Portable Document Format (PDF)* isn't a recent file format, but its use on the Web is increasing constantly. PDF files are created by importing files with varying formats into Adobe Acrobat. A PDF serves as a presentation framework in which the imported file can be displayed with its original formatting intact. Files can thus be read across various operating-system platforms without the applications used to create them, provided the user has the (free) Adobe Acrobat Reader, which is available as a separate program or as a plug-in for Microsoft or Netscape browsers.

The hype about *push* technology—where data is sent to the user instead of waiting to be requested—has pretty well completely abated, but push channels are still out there, at least for the time being. Microsoft's *Channel Definition Format (CDF)* offers a means of defining what documents are to be included



in a channel and when they are to be sent to the user's machine. CDF uses *XML (Extensible Markup Language)*, and in fact the file format is simply that of XML with specific tags and elements. The format contains details about the authorship of the file, the PICS ratings code (if the author wants to recommend viewer discretion), whether or not the file is to be cached on the user's local disk, and the scheduling of the downloads. Many of these elements are set by the user when first requesting a particular channel.

Macromedia's *Shockwave Flash* technology provides a means for Web developers to include high-quality animations and sounds in their pages. Users need browser plug-ins to experience Flash applications, and they can be time-consuming to download, but the quality of these multimedia files often outweighs the disadvantages. The *SWF* file format specifies details such as how to display the movie/animation, frame by frame and shape by shape. Definition tags within the file describe how the text,

buttons, sounds, sprites, and bitmaps will appear, while control tags handle the objects' behavior on the screen. SWF files have specific compression techniques, and the format is designed to be independent of other system display elements, such as fonts and colors.

NO END IN SIGHT

New file formats will always be developed. Some will be attempts to improve on or replace existing formats, similar to *PNG (Portable Network Graphics)*, which has been touted for a few years now as a replacement for GIF. Others will be amendments to existing formats, as MP3 is to MPG. Most, however, will be formats for new applications, designed to feature attributes not available in earlier applications. Basically, as long as new software is developed, new file formats will be developed with them. And a few will go on to become standards. Understanding what the various file types are for and keeping up with new ones will help you get the most out of your computing experience. **PC**

Neil Randall is a contributing editor of PC Magazine and the author of *The Soul of the Internet (ITCP)* and *Special Edition Using Microsoft FrontPage98 (Que)*.



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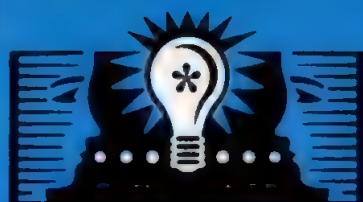
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USER TO USER

Quick Access to Most-Used Programs

If you'd like to run programs quickly from your *Start* menu, just give each shortcut a unique number or letter. Then you can run your applications simply by hitting the Windows key and its number or letter. With this technique, I can use my left hand to start my Internet connection with one fluid motion (Windows key, then 1), without having to change the position of my mouse. I also number the programs in order of importance so my most frequently used apps are at my fingertips.

Brent McGraney
Scarborough, Ontario, Canada

PC This tip works only for menu items added directly to the *Start* menu itself, not for items in the *Programs* submenu. Before you begin adding items, bring up the *Start* menu and make a note of which character is underlined in each menu item. The underlined character defines the shortcut key for that item; you'll have to pick an unused character for each item you add. Note that if your keyboard doesn't have a Windows key, you can press Ctrl-Esc instead.

To add an item to the *Start* menu, right-click the taskbar, choose *Properties* from the menu that pops up, and click the *Start Menu Programs* tab in the resulting dialog box. Click the *Add* button and either enter the full pathname of the program or click the *Browse* button to make a selection. When you click *Next*, you'll get a view of the *Start* menu laid out in tree format (Figure 1). Select the *Start* menu itself, at the top of the tree, and click *Next*. When asked to select a name for the shortcut, be sure to include the shortcut key character, and precede it with an ampersand (&). For example, to name a shortcut for Regedit.exe with 2 as its shortcut key, you might use &2Regedit. When you

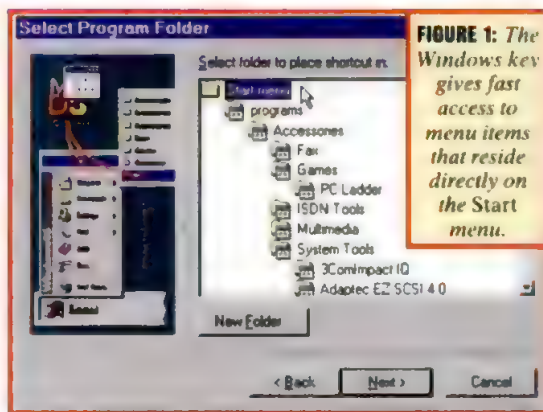


FIGURE 1: The Windows key gives fast access to menu items that reside directly on the *Start* menu.

click *Finish*, the shortcut is added. You can add more shortcuts now, or click *OK* to put away the *Taskbar Properties* dialog box. —Neil J. Rubenking

Restoring a Lost New Submenu

PC A number of readers have complained that they've lost the *New* submenu from the standard right-click context menu for folders and for the desktop. I'm pleased to offer a solution, based on an article from Microsoft's Knowledge Base (article Q180257, support.microsoft.com/support/kb/articles/q180257.asp). The problem is caused by an incorrect or missing value in the registry.

Fixnew.reg, shown in Figure 2, will solve the problem. Note that the file consists of just three

```
REGEDIT4
[HKEY_CLASSES_ROOT\Directory\
Background\shell\ex\
ContextMenuHandlers\New]
@="" [D969A300-E7FF-11d0-A93B-
00A0C90F2719]"
```

FIGURE 2 If the *New* submenu has vanished from the context menus for folders and the desktop, launching this file should restore it.

lines (though it is formatted differently for publication). The second line is enclosed in square brackets [] and doesn't contain any spaces or hyphens. The third line consists of @= followed by a string of characters enclosed in double-quotes. Download this file from www.pcmag.com (get the PC Tech archive for this issue), or

create it using Notepad, then launch Windows Explorer and double-click the Fixnew.reg file. You should get a message from the Registry Editor saying that the information from the file has been successfully entered into the registry. Right-click the desktop; the *New* submenu should be back. —Neil J. Rubenking

Not Seeing Red

I have a monitor that fails to display red colors most of the time. Occasionally the display will flicker and all those pretty reds will appear, only to go away after a few seconds. A sharp tap on the monitor case or a jolt to the desk will sometimes cause the reds to reappear briefly.

Is it possible that there is a loose connection within the monitor case? In all other respects, the display is just fine; but red text on a black background is not visible, since the reds display as black unless I whack the monitor a good one.

I feel confident that I can investigate the innards of my monitor without immediately electrocuting myself, but is it likely that I will be able to locate the problem (assuming it is a loose connector) without all kinds of elaborate testing equipment?

John Druary
Houston, Texas

PC Yes, the most likely answer is that you have a loose connection inside your monitor, somewhere between the red signal input on the monitor's cable connector and the red electron gun in the CRT (cathode-ray tube). This problem can be easily located using a simple continuity tester, and it can just as easily be repaired. The chances are good, by the way, that the monitor may soon stop responding to the head-banging treatment—not to mention that you may also introduce additional damage. So you should probably get it repaired sooner rather than later.

However, you should definitely not open the case and try to fix the problem yourself. The circuitry inside a monitor is sophisticated, to say the least, and the voltages used to drive the electron guns can range in the tens of thousands—enough to cause serious physical injury. Some of the circuits can act as large capacitors, storing charges when the power is turned off, even when the monitor is unplugged from the

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electrical outlet. As a result, the risks to the untrained are significant. It's best to leave any and all repairs to professionals.

As for whether it's worth spending the money to have a professional service fix the monitor, that depends on how old it is and how much replacing it with a new one would cost. Most repair shops will likely charge between \$50 and \$150, including labor cost, even though the fix is easy. But if the monitor is newer than three years old, it's probably still under warranty from the company you bought it from. If it's older than that, consider the fact that new 17-inch screens start at around \$300, and 15- and 14-inch units could even cost less than the repair. It all depends on what you need and how much you value the flaky monitor you're currently stuck with.—*Alfred Poor*

View Files of Unknown Type as Text

Here's something that can make your life easier: The WSH script (in Figure 3) lets you view any unknown file as text with a simple right click.

Cameron Clark
Sour Lake, Texas

PC Before you can use this script, you'll need to make sure the Windows Scripting Host is installed on your machine. If it's not, go to the current Web address for Microsoft Scripting Technologies, <http://msdn.microsoft.com/scripting>, to get a copy. If you don't find it there, a search of the Microsoft Web site should turn it up. You'll find downloading and installing the WSH are worth the trouble. Writing a WSH script is nearly as easy as writing a batch file, and the scripts can manipulate elements of the Windows environment such as the registry, shortcuts, and the file system in ways that would previously have required a full-scale programming language.

Once the WSH is installed, launch the file `Vuastext.vbs` by double-clicking on it. You need to do this only once; thereafter you'll find that a View



as text option appears on the right-click context menu for all files without system-defined file types. This particular script relies on the `WSHShell` object defined near the top. It uses the object's `ExpandEnvironmentStrings` method to get the full pathname of `Notepad.exe` in the Windows directory. One call to the `RegWrite` method creates the key that puts *View as text* on the context menu, and another writes the full pathname for `Notepad.exe` as the command associated with this menu item. It seems almost simple, because the Windows Scripting Host handles the difficult parts, but imagine doing this with a batch file!—*Neil J. Rubenking*

Dead-Computer Purchase a Bargain?

I'm considering purchasing a used notebook that I've seen advertised by a private party through a Web classified. It's a Pentium/75 model with 8MB of memory, an active-matrix

screen, and no CD-ROM or modem. The problem is that the notebook's owner has lost the power supply, and apparently the computer won't boot even when it has a fresh battery installed. Is this something that I may be able to fix myself?

Jack Moskovita
via the Internet

PC In general, buying used equipment—even if it's not working—can make sense, provided that you've done your homework and are comfortable that the ratio of risk to reward justifies the reduced price you would pay.

Check the used-equipment market, both on the Web and in print, and find out what the going rate is for similar products. Currently, a Pentium/75 notebook with 16MB and sound can be found for under \$500, and that's a system in working condition with as much as a 90-day warranty. Often, individuals have an inflated view of what their used equipment is worth, and you can usually do better by going to the open market.

In this case, the solution may be as simple as locating a replacement power brick for the laptop, so the extra cost to get the system running may be quite small. On the other hand,

there may be internal problems with the unit's power-processing circuitry, which may be prohibitively expensive to repair. It is also possible that there are other problems—such as a defective display or hard disk—that will not be revealed until the laptop is powered up and tested.

One possible approach would be to find a reputable notebook repair facility and get a price for evaluating the system and a quote for any required repairs. If you're willing to pay for the inspection, the seller may accept your offer to buy contingent on the results of the inspection report. It may well be, however, that it's not worth risking even the inspection fee.

So do the math and weigh the risks. Buying a dead computer can sometimes be a good deal, but the price has to be right in order to cover your risks; there is always the possibility that you may not be able to resurrect it at an affordable cost.—*Alfred Poor*

```
Dim WSHShell
Set WSHShell = WScript.CreateObject("WScript.Shell")
Const unknownKey = "HKEY_CLASSES_ROOT\Unknown\Shell"
Const contextString = "View as Te&xt"
Const command = "Command"
Const BS = "\"

'//=====
'// ::SKELETON::
'// - Get notepad's path
'// - Create command to open notepad with a given file
'// - Assign the command to unknown files
'// - Tell the User what you did
'//=====

Dim s
s = "%windir%\notepad.exe"
s = WSHShell.ExpandEnvironmentStrings(s)
s = s + " %1"

dim newKey
newKey = unknownKey + BS + contextString + BS
WSHShell.RegWrite newKey, ""
newKey = newKey + command + BS
WSHShell.RegWrite newKey, s
MsgBox("You can right-click an unknown" + vbCrLf + _
       "file and select 'View as Text'.")
```



FIGURE 3 This WSH script adds a View as text option to the context menu for all files without defined file associations.

Colorful Equations in Microsoft Word 97

Is there any way to make an Equation Editor 3.0 equation in a Word 97 document show and print as any color other than black? I would like to make the equations stand out in my documents.

William Xue
via the Internet

PC Although you can't change color in the Equation Editor, there are at least three workarounds for changing the color of the final equation. Each has drawbacks, however, so you'll have to decide which one works best for you.

One choice is to use the equation field instead of the Equation Editor. Using the field will let you change color just as you would change the color of text: Select the field and choose *Format | Font* or the *Formatting* toolbar's *Font Color* button. However, defining a complex equation with a field can be confusing, which is precisely why Microsoft long ago introduced the Equation Editor.

If you take this route, note that unless you're familiar with the field's options, the easiest way to enter the field is to choose *Insert | Field*, then choose *Equations and Formulas* from the *Categories* list and *EQ* from the *Field Names* list. Next, choose *Options* and pick from the various switches to design the equation.

Be aware too that if you double-click on an equation field, Word will convert it to an Equation Editor equation and open the Equation Editor, changing the color back to black in the process. To restore it as a field, close the Equation Editor and choose *Edit | Undo*. An advantage of this method is that using the right-click *Toggle Field Codes* choice, you can assign different colors to different parts of the equation.

The second workaround is to convert the Equation Editor equation into a picture object. Before you try this (or the third approach, which I'll get to in a moment), save a copy of the document under another name so that you'll have the original equation available should you need to edit it.

To convert the equation into a picture, select it and hit Ctrl-Shift-F9, the *Unlink Fields* command. Then double-click on it to open it as a picture in Word's picture-editing screen. You can then select the text and symbols to change their color. This method also lets you color-code individual parts of the equation. The catch is that in order to color the entire equation, you have to do a lot of selecting. Each section of text—such as the ab , the $+$,



One choice is to use the equation field. But defining a complex equation with a field can be confusing, which is precisely why Microsoft introduced the Equation Editor.

and the c in $ab + c$ —will be in its own text box. You can select the text and change color—with the *Font Color* toolbar button or the *Format | Font* command—for only one text box at a time. You also have to select each line or other drawing object separately before changing color with the *Drawing* toolbar's *Line Color* button or the *Format | AutoShape* command. And note that some symbols consist of multiple individual lines (four for the square root symbol, for example).

To make the selection of objects and text easier, choose *View | Zoom* or the *Zoom* button, and set the zoom to 500 percent. It's also a good idea to group the drawing objects. Hold the Shift key down as you select each one, and choose *Draw | Group* from the *Drawing* toolbar. Once you've grouped all the nontext objects, you can reselect them with a single click should you want to change colors again. When you're finished changing colors, choose the *Close Picture* button to return to your document.

The third workaround lets you change color more easily but degrades line quality in printed output, because it turns text and symbols into bitmapped images. And you can change the color only of the entire equation, not parts of it. In my tests, it also printed with duller colors than with the other two approaches. However, you should find this method acceptable if you expect people to read the file on-screen (after saving in HTML format, for example) or don't mind the loss of quality in the printout. To use this approach, you first have to install Microsoft Photo Editor, which comes with Office 97.

As with the second approach, create the equation, then select it and hit Ctrl-Shift-F9. While it's still selected, choose *Edit | Copy*, then open or move to Photo Editor. Choose *File | New* to open a blank picture window, make sure the image type is set to 256 colors, and choose *OK*. Ignore the *Resolution* setting, which won't affect the image. The width and height have to be large enough for the equation to fit, but if it doesn't fit the first time, you can choose *File | New* again and adjust the size.

Paste the equation into the picture window with *Edit | Paste*, then unselect the equation by clicking anywhere on the window outside the selection, and choose *Image | Balance*. You'll want to experiment with the balance settings to see how they affect the color. If you choose *Red* in the dropdown list, for example, and set *Brightness* to 100 and *Contrast* to 0, you'll wind up with red on a white background. When you're done adjusting the color, choose *OK*. Then use the selection tool to select the equation, choose *Edit | Copy*, move back to Word, and choose *Edit | Paste* to insert the newly colored equation into the document.

As already mentioned, the equation will print with somewhat jagged edges and with duller colors than equations created solely in Word. However, you won't see the difference on-screen. Note too that equations will print more readably with some colors than with others. If you plan to print the final result, run some tests first to see which colors work best on your printer.

You can improve the readability of the printout by defining the text as bold in the original equation. You can also improve line quality by zooming your view to 500 percent before copying the equation to Photo Editor, then resetting the image to 100 percent before pasting the modified equation back into Word. When you paste the image back into Word, it will be too large, but when you resize it, the resolution will improve and raggedness will be minimized.

—M. David Stone

Exceeding Excel's Nested IF Limit

About two years ago, my company switched from individual packages of Corel WordPerfect and Lotus 1-2-3 to Microsoft Office. The conversion of the old documents and spreadsheets went well, except for a few of my spreadsheets. Under 1-2-3, I had a few cells containing similar nested IF...THEN statements. These cells looked to another cell, checking for the month of

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My real job is being a single dad, but my business card says I'm an architect.

The other day we're upgrading the office, and I'm doing the buying. We need five screaming Intel® Pentium® II boxes, two PC servers and several color printers. So I pop onto ZDNet's Products Review channel to read some reviews, then click over to computershopper.com to shop, compare and buy. An hour later my work is done.

So I take off a little early, swing by Kate's daycare and head home. I make us some sandwiches and we get to work on my favorite housing project yet.

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the year. Once the month was found, the formula put an identified percentage in the cell for that month. For example:

```
@IF(A1="January",.33%,@IF(A1="February",.45%,@IF(A1="March",.50%,@IF(A1="April",.66%,"ERROR"))))
```

This formula went on for all 12 months of the year. When we imported the spreadsheet into Excel, the formula no longer worked. I find that I can get, at most, only 7 months in the formula instead of the full 12-month statement that I could use in 1-2-3. Is there any way to get this formula to work? If not, what kind of a formula can I write that will do the same job?

Ruben Medina
via the Internet

PC Excel appears to have a limit of eight nested IFs. I was able to get Mr. Medina's formula working out to August, but no farther. It's possible that 1-2-3 has some limit on the complexity of @IF formulas—but the limit is obviously more generous than Excel's, because a full year's worth of Mr. Medina's formula causes no problem in 1-2-3 (Release 9).

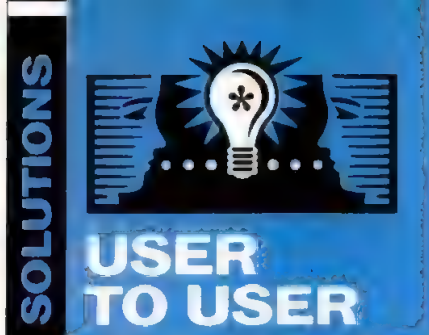
Writing the formula in 1-2-3 and exporting it to Excel accomplish nothing, of course. Excel simply chokes and returns the formula's current value.

The "proper" way to solve this problem (that is, the approach that Excel's designers require) is to use a lookup formula. You can arrange the lookup table either horizontally or vertically, although making it vertical seems like the more natural method. Create a two-column table, with months in the first column and associated values in the second. Then write the formula

```
=VLOOKUP(LookupCell, LookupTable, 2, FALSE)
```

where LookupCell is the cell whose associated value you want to return (A1 in Mr. Medina's example) and LookupTable is the table of months and values. The third argument, 2 in this case, tells Excel to get a value from the second column; the fourth argument, FALSE, relieves you of the need to alphabetize the months. If you omit this optional argument and put the months in chronological rather than alphabetical order, the formula doesn't work.

So the bad news is that if you're converting 1-2-3 worksheets with deeply nested @IF formulas, you have to reorganize and rewrite. The only good news is that a lookup table really is a sounder and more robust



way to do the job. With a lookup table, you can see and edit your values more easily. You can also have a single table that feeds formulas in many different places. That table can reside anywhere, including in an external worksheet somewhere out on your hard disk or server.—Craig Stinson

Setting a Field's Description Property

How do I return or set the description property of an Access TableDef's field in VB or VBA? Do I need to use automation? Can I do it with Data Access Objects? If so, how?

Josh Hildley
Santa Barbara, California

PC You can use Data Access Objects (DAO) to get or set a field's description property. You must be aware, however, that Microsoft Access does not create the description property until you actually type in a description. Thus if you create a field using the Access interface and do not specify a description, the description property is not created. Attempting to retrieve a description property that does not exist generates an error.

You can test for this condition in your

code. Figure 4 shows an example of the IsDescriptionExist function. You pass the function the name of the table and the name of the field in the current database, and it returns either True or False to indicate whether a description property exists for that field. The code attempts to retrieve the description property and responds by returning False to the error that occurs if the property does not exist.

I've also written SetDescription and GetDescription sample functions, which you can use to set or get the description property for a given table and field. To get the description property you should begin by calling IsDescriptionExist to make sure the description property exists. If it does, then call GetDescription to obtain its value.

To set the description property you call the SetDescription function, passing the name of the table, the name of the field, and the value for the description property. If the property doesn't exist, the SetDescription function automatically creates it and adds it to the field's properties collection.

One of the best sources for information on Jet 3.5 and DAO is *Microsoft Jet Database Engine Programmer's Guide*, Second Edition, by Dan Haught and Jim Ferguson. The book is published by Microsoft Press and is indispensable if you're a database developer using Microsoft Access, Jet, and DAO. I recommend it highly.

All of the code mentioned here can be downloaded from PC Magazine Online. Look for the file named Setgetde.mdb in this issue's PCTech archive.—Sal Ricciardi **PC**

```
Function IsDescriptionExist(strTable As String, strField As String) As Boolean
Dim dbs As Database, tdf As TableDef, strValue As String
Const conPropNotFound As Integer = 32768
On Error GoTo IsDescriptionExistErr
Set dbs = CurrentDb
Set tdf = dbs.TableDefs(strTable)
strValue = tdf.Fields(strField).Properties("Description")
IsDescriptionExist = True ' If no error occurred the property must exist
IsDescriptionExistExit:
Exit Function
IsDescriptionExistErr:
IsDescriptionExist = False
If Err.Number = conPropNotFound Then
Else
MsgBox "Error " & Err.Number & ": " & _
vbCrLf & Err.Description, , "Error: IsDescriptionExist"
End If
Resume IsDescriptionExistExit
End Function
```

FIGURE 4 The function shown here can be used to test for the existence of a field's description property in an Access table.



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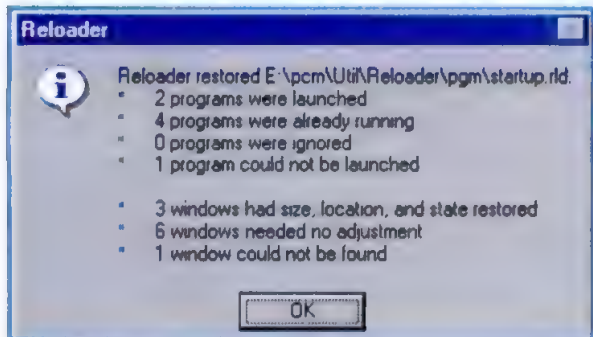
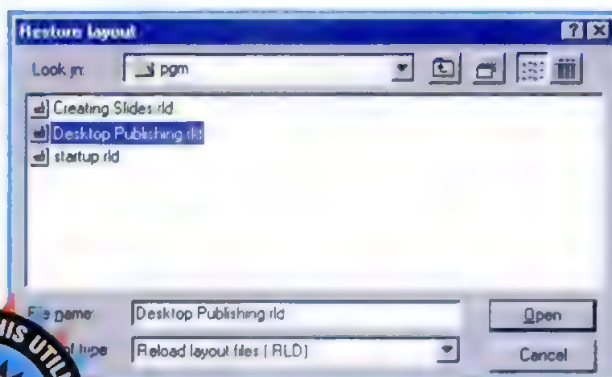
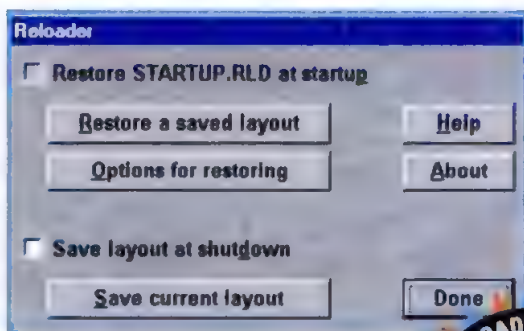
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Reloader runs under Windows 95, Windows 98, and Windows NT 4. An article about how to use Reloader and how it was written is available on our Web site at www.pcmag.com/pctech/index-ut.html. A link for downloading the utility and its source code can also be found there.

Neil J. Rubenking, the author of Reloader, is a contributing technical editor of PC Magazine. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

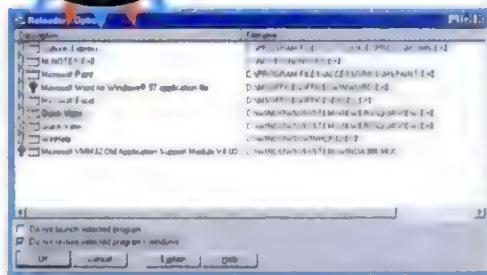
Reloader lets you save the layouts of running programs automatically at shutdown or manually at any time. You can then restore saved layouts automatically at start-up or manually as needed.



▲ After reloading a layout, Reloader displays a report of its success in restoring the various processes and windows. Some items, such as DOS boxes, cannot be restored by Reloader. Details about items not restored can be found in the Options dialog.



▲ One handy use for Reloader is quickly loading the applications used for a specific purpose, such as desktop publishing. To load a particular layout at start-up, give it the name Startup.rld.



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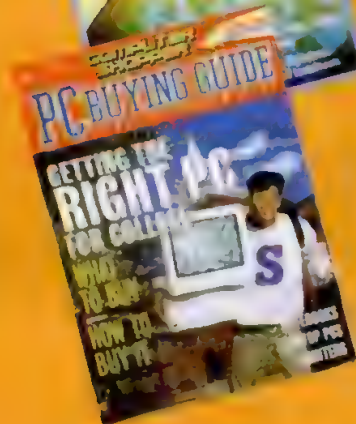
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PC TECH

Programming for Windows CE Devices

By Douglas Boling

Windows CE is the "third" Windows. This new operating system isn't nearly as well known as its two larger cousins, Windows 98 and Windows NT, but that's beginning to change. Windows CE is designed for small, battery-powered devices such as personal organizers. While these devices look quite different from desktop and laptop PCs, the techniques used to program Windows CE devices are similar to those used for Windows-based PCs. We'll take a look at how to program Windows CE devices, but first it's important to understand just what Windows CE is, to separate the operating system from the individual platforms that run Windows CE.

Windows CE is a totally new version of Windows. It isn't a modified or stripped-down version of either Windows 98 or Windows NT. Instead, Windows CE was designed from the ground up as a new operating system for battery-powered devices smaller than standard PCs. Users may be more familiar with the Windows CE devices, such as hand-held PCs or Palm-size PCs, than with the operating system itself. These platforms, built by OEMs such as Hewlett Packard and Casio, bundle a version of Windows CE in their ROMs. Because of this, users never install Windows CE; it comes by default on these devices.

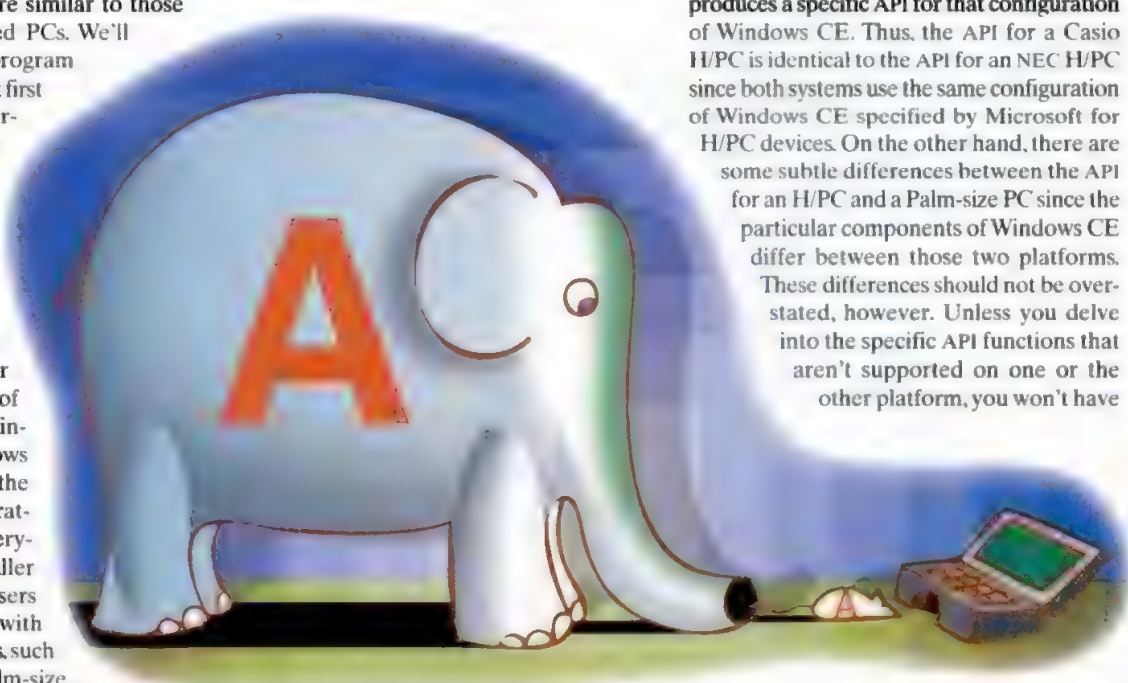
Windows CE supports a subset of the ubiquitous Win32 API used in Windows 98 and Windows NT. While the word *subset* might send chills down the spine of a Windows NT developer, rest assured that the differences in the API between the desktop Windows versions and Windows CE don't cause too many challenges. The differences mainly involve

elimination of the redundant functions that exist in the Win32 API for backward compatibility with previous versions of Windows. For example, there may be three or four ways to open a file programmatically in the desktop versions of Windows; under Windows CE there is only one, `CreateFile`.

Other differences in the API occur in areas where Windows CE doesn't implement the entire array of functions that Windows NT

The other major difference between Windows CE and its larger cousins is that it is designed to be reconfigured by OEMs to better fit specific hardware platforms. For example, the requirements for a hand-held PC professional, which is a mini-notebook that runs Windows CE, are much different than those of a Palm-size PC device. Because of this, Windows CE can be *componentized* to remove parts of the operating system that may not be needed on the target platform. This goes far beyond simply not including a DLL in a specific platform. Windows CE can be configured so that, for example, the cursor API that controls the look of the pointer on the screen, or even the clipboard component, can be removed if it is deemed unnecessary for the specific hardware platform.

This componentization of Windows CE is done by the OEM for vertical market platforms, or by Microsoft for the horizontal platforms. A particular componentization mix produces a specific API for that configuration of Windows CE. Thus, the API for a Casio H/PC is identical to the API for an NEC H/PC since both systems use the same configuration of Windows CE specified by Microsoft for H/PC devices. On the other hand, there are some subtle differences between the API for an H/PC and a Palm-size PC since the particular components of Windows CE differ between those two platforms. These differences should not be overstated, however. Unless you delve into the specific API functions that aren't supported on one or the other platform, you won't have



does. For example, the Winsock library supported by Windows CE doesn't include most of the WSAAsync functions supported by Windows 98 and NT. There is no loss of functionality in the Windows CE version, you just have to use a more pure Berkeley version of socket programming when using sockets under Windows CE. For Windows programmers, this means you need to learn how to use basic blocking and nonblocking sockets without the helpful WSAAsync functions that, on Windows 9x and NT, notify applications when socket events occur.

any trouble writing an application that runs on both. You can always avoid the problem of platform-specific functions by explicitly linking to the functions specific to that platform using `LoadLibrary` and `GetProcAddress`.

In fact, the biggest challenge in writing an application that runs on both platforms is dealing with the different screen sizes used by the two platforms. For example, the landscape screen of the H/PC (640 by 240) requires a different layout for dialog boxes than does a Palm-size PC's portrait screen (240 by 320). A good solution in this case is to create a single

ILLUSTRATION BY MILAN TRENC



dialog box procedure with separate dialog-box templates for the two screen sizes. This way, the proper template can be determined at runtime by the application.

Another challenge of programming Windows CE devices is the perpetually low memory environment in which your application must survive. While Windows CE supports demand paging, it doesn't support a paging file to save read/write data on secondary storage such as a hard disk. In other words, read-only pages, such as application code and an application's read-only data are brought into memory as needed. However, read/write data is never saved in a paging file on a hard disk. This limited demand paging decreases the time it takes to launch Windows CE applications because only the parts of the application that are necessary at start-up are loaded. But it also means that since Windows CE doesn't support a paging file to save read/write mem-

can one development environment be expected to know the target platform? To deal with this, Microsoft has produced an array of development tools for Windows CE, some compatible with all platforms, some supported only on the hand-held PC and hand-held PC professional systems.

The tools are designed to run under Windows NT. Code development is performed in a Developer Studio environment using one of the supported languages indicated below. The code is executed on a Windows CE device attached to the development PC using either a serial link or a network link. The serial link is the standard connection used by

With this in mind, we'll limit our discussion to Visual C++, although there are plenty of reasons you might want to use the other languages on an H/PC or H/PC Pro.

To write a Windows CE application in C or C++ you first install the standard PC version of Visual C++ (either VC++ 5.0 or 6.0) then the add-in product, Visual C++ for Windows CE. This product, available from Microsoft, provides compilers for all the target CPUs supported by Windows CE and it also includes a version of MFC and ATL supported on H/PCs. The add-in doesn't prevent you from writing PC-targeted applications, it simply extends the targets so that you can develop for Windows CE.

At this point, you still need the include and lib files necessary to compile a Windows CE application for a particular platform so, if you're writing for a standard horizontal platform, the next step is to install a platform SDK for that specific platform. These platform SDKs are free from Microsoft and are available on the Microsoft Web site (<http://www.microsoft.com/windowsce/downloads/pccompanions/default.asp>). When you buy Visual C++ for Windows CE, the platform SDK for the H/PC is usually included on the CD, but it's always a good idea to check the Web site to determine if a newer version is available.

If you're porting Windows CE to a new hardware platform, Microsoft offers another tool, the Windows CE Platform Builder, the successor to the Embedded Toolkit that was used with earlier versions of Windows CE. This tool provides the operating system in an object lib format so it can be componentized by the developer for a specific platform. The Platform Builder also includes the necessary tools for a developer to create a custom platform SDK for the componentized version of the operating system being developed.

Although there's no real need for a software developer who is writing applications for H/PC or other horizontal platforms to use the Platform Builder, it's definitely worth having if you're serious about Windows CE development. This is a complex set of tools, but the information about the architecture of Windows CE you'll gain by working with the Platform Builder is invaluable. We'll talk more about the Platform Builder later.

THE BASIC DEVELOPMENT CYCLE

Now let's turn to writing an actual Windows CE application. The steps you take are the same as those for writing an application for desktop versions of Windows. First, you create a new workspace within Visual C++. Although you can use one of the many wizards

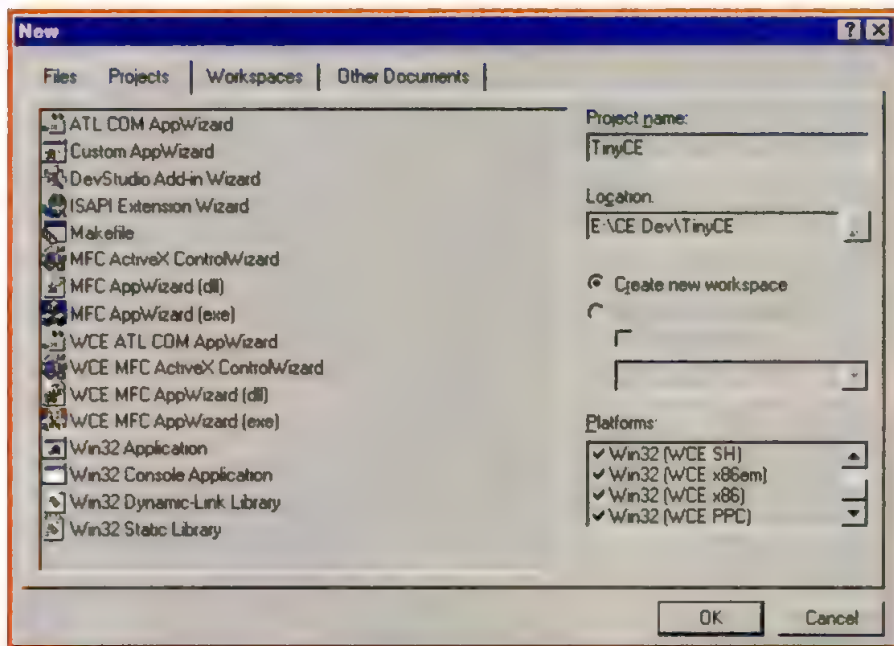


FIGURE 1: You can create a Windows CE application manually in the VC++ environment by selecting Win32 application and checking off the Windows CE target processors you want.

ory, applications are strictly limited to the amount of physical RAM on the device. Because of this, it's quite possible your application will run out of memory at times. You must therefore write Windows CE applications to use as little RAM as possible and to handle out-of-memory situations gracefully.

TOOLKITS

The flexibility of Windows CE presents a challenge to the folks who write programming tools. Since Windows CE supports a variety of CPUs and can be configured in a multitude of ways, each with a different API, how

Windows CE devices to synchronize data between the device and the PC. Network links provide much faster download speed but, unfortunately, some of the debugging tools don't run when the Windows CE device is attached via a network link.

Microsoft supports versions of Visual C++, Visual Basic, and Visual J++ for one or more of the Windows CE platforms. Visual Basic and Visual J++ for Windows CE are only supported for the hand-held PC and hand-held PC professional systems. At present, to write for the other platforms you must use Visual C++, which is supported across the board.

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designed to assist you in creating Windows CE applications, you can also create one manually by selecting Win32 application, and checking off the Windows CE target processors you want (see Figure 1).

Once the project is created, you simply write the code and create any resources, including menus, icons, and dialog box templates, almost exactly as you would when writing an application for Windows 98 or Windows NT, with the exception of the aforementioned differences in the API. As we noted earlier, the differences aren't major; nevertheless, a few distinctions in the Windows CE programming model should be noted. First, and on the surface most surprising, top-level windows under Windows CE don't support menus. This doesn't mean that Windows CE applications can't have menus, it's just that they are supported through the command bar control.

The command bar control and its more complex cousin, the command bands control, combine menu and toolbar support as well as a place for application-close and help buttons for Windows CE applications. The controls are designed to be fairly straightforward to program. In fact, a simple command bar that provides a menu and an application-close box takes only three lines of code. The command bands control extends the command bar concept by allowing the components of the command bar, the menu, buttons, and other controls to be separated into separate bands that can be arranged by the user. This control is based on the rebar control developed for Internet Explorer 3.

Another difference with Windows CE applications is that icons are assigned on a class basis within an application, not a window-instance basis, meaning that two windows of the same window class will have the same icon. This doesn't really have much of an impact since a window's icon is displayed only in the taskbar button for the window.

Aside from these issues, most of the other differences have more to do with programming conventions than with programming restrictions or implementation differences. For example, while Windows CE top-level windows can have title bars, by convention they don't. Removing the title bar saves space on the small screens used by Windows CE devices. On the desktop versions of Windows, the title bar is used to drag a window around the screen. This function isn't used often on Windows CE systems since by default, top level windows in Windows CE are all full-screen.

This is a good place to mention one of the new features of Windows CE. Starting with



Windows CE 2.1, the window manager supports standard, resizable windows. While the operating system always supported windows of any fixed size, now the window manager supports a sizing border around overlapped windows so that they can be resized by the user. You won't see this used on the new H/PC

Pro machines very often, however, since the default is for top-level windows to be full screen, even for these large-screen systems.

With these caveats, let's look at a simple Windows CE application. Figure 2 shows source code for the simple TinyCE application that just displays a line of text in its main window. At first glance, Win32 programmers will be hard pressed to notice the subtle differences between this application and a Windows 98 or NT application. The program has the same window-class registration, window creation, message loop, and window proce-

```
//-----
// TinyCE - A small Windows CE application
//
#include <windows.h>
#include <commctrl.h>           // Command bar includes

LRESULT CALLBACK MainWndProc(HWND, UINT, WPARAM, LPARAM);

TCHAR szAppName[] = TEXT ("TinyCE");
HINSTANCE hInst;

//-----
// Program entry point
//
int WINAPI WinMain (HINSTANCE hInstance, HINSTANCE hPrevInstance,
                    LPWSTR lpCmdLine, int nCmdShow) {

    WNDCLASS wc;
    HWND hWnd;
    MSG msg;

    hInst = hInstance;
    // Register App Main Window class
    memset (&wc, 0, sizeof (wc));
    wc.lpfnWndProc = MainWndProc;           // Callback function
    wc.hInstance = hInstance;              // Owner handle
    wc.hbrBackground = (HBRUSH) GetStockObject(WHITE_BRUSH);
    wc.lpszClassName = szAppName;         // Window class name
    if (RegisterClass(&wc) == 0) return -1;

    // Create main window
    hWnd = CreateWindow (szAppName,        // Window Class
                        szAppName,        // Window Title
                        WS_VISIBLE,       // Style flags
                        CW_USEDEFAULT,    // x position
                        CW_USEDEFAULT,    // y position
                        CW_USEDEFAULT,    // Initial Width
                        CW_USEDEFAULT,    // Initial Height
                        NULL,              // Parent
                        NULL,              // Menu, must be null
                        hInstance,         // App instance
                        NULL);             // Ptr to create params

    // Return fail code if window not created
    if (!IsWindow (hWnd)) return -2;

    // Standard show and update calls
```

FIGURE 2: This code illustrates how similar Windows CE applications are to ordinary Windows apps.

dures as any other Windows application. The differences in the example reflect differences in the API as discussed above, such as the use of a command bar to provide a close box. Once the code is written, you use the exact same techniques to compile and run it as you would with a desktop application. Compiling does include an extra step to download the resulting EXE or DLL automatically to the attached Windows CE device. You can then execute the program on the Windows CE device by selecting the same *Program | Run* menu item (or *Ctrl-F5*) as you would to run a Win-

dows NT program under development.

And, yes, you can step through the program using the integrated debugger. The main difference between debugging a Windows CE application and debugging a local Windows NT application is the impact of the speed of the serial link that connects the development PC with the remote Windows CE system. This link makes single-step debugging a slow and painful process. In fact, I tend to use the debugger for only solving the most intractable of bugs.

There are alternatives to using the remote

debugger. The platform SDKs for the H/PC, Palm-size PC and Auto PC all include emulator programs that attempt to emulate the remote Windows CE device on Windows NT. This emulator runs a specially compiled version of your application. It emulates the Windows CE API including the extensions such as the database API. The problem with the emulator is that it does not model the Windows CE environment perfectly. There may well be times when, after a day's work, you realize the problem you're chasing is an emulator issue, not a bug in your code.

It's a good idea to create your Windows CE application so it can be compiled for both Windows CE and Windows NT, thus avoiding emulator problems. This approach lets you work on the generic parts of the application locally under Windows NT and, simply by selecting a different target, compile for Windows CE. But if you do this, remember not to stay too long on either platform. If you spend too much time compiling for Windows NT, it may take some work to make the changes for the program to run under Windows CE.

Writing code that will compile for both Windows NT and Windows CE isn't too difficult. For those parts of the code specific to a particular operating system, use compiler defines to have those sections selectively compile for the specific OS. In the code fragment below, the functions for creating a command bar are encapsulated in # conditional compile statements so they will be included only when compiling for Windows CE.



```
ShowWindow (hWnd, nCmdShow);
UpdateWindow (hWnd);

// Application message loop
while (GetMessage (&msg, NULL, 0, 0)) {
    TranslateMessage(&msg);
    DispatchMessage(&msg);
}
return 0;
}

// Main Windows Procedure
//
LRESULT CALLBACK MainWndProc(HWND hWnd, UINT wParam, WPARAM wParam,
                                LPARAM lParam) {
    HWND hwndCB;
    PAINTSTRUCT ps;
    RECT rect;
    HDC hdc;

    switch (wParam) {
    case WM_CREATE:
        // Create a minimal command bar that only has an exit button.
        hwndCB = CommandBar_Create (hInst, hWnd, 0x10);
        CommandBar_AddAdornments (hwndCB, 0, 0);
        break;

    case WM_PAINT:
        // Adjust the size of the client rectangle to take into
        // account the command bar height.
        GetClientRect (hWnd, &rect);
        rect.top += CommandBar_Height (GetDlgItem (hWnd, 0x10));

        hdc = BeginPaint (hWnd, &ps);
        DrawText (hdc, TEXT ("Hello Windows CE!"), -1, &rect,
            DT_CENTER | DT_VCENTER | DT_SINGLELINE);
        EndPaint (hWnd, &ps);
        break;

    case WM_DESTROY:
        break;
    }
    return DefWindowProc(hWnd, wParam, lParam);
}
```

```
#ifdef _WIN32_WCE // If compiling
for CE
    HWND hwndCB;
    // Create a command bar.
    hwndCB = CommandBar_Create (hInst,
        hWnd, IDC_CMDBAR);
    // Add exit button to command bar.
    CommandBar_AddAdornments (hwndCB,
        0, 0);
#endif // _WIN32_WCE
```

Of course, writing code is only part of application development. You also need a set of tools to debug and test the application. When you install Visual C++ for Windows CE, a set of remote tools is installed to help you with debugging the Windows CE applications. For the most part, these tools mirror the tools used for desktop Windows debugging. There are Windows CE versions of Regedit, for editing the registry on the Windows CE device; Spy, to monitor messages received by Windows CE windows; and ZoomIn, for examining window pixels. You also get a process monitor that lets you see and monitor the status of the

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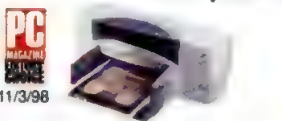
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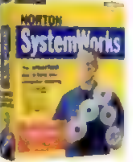
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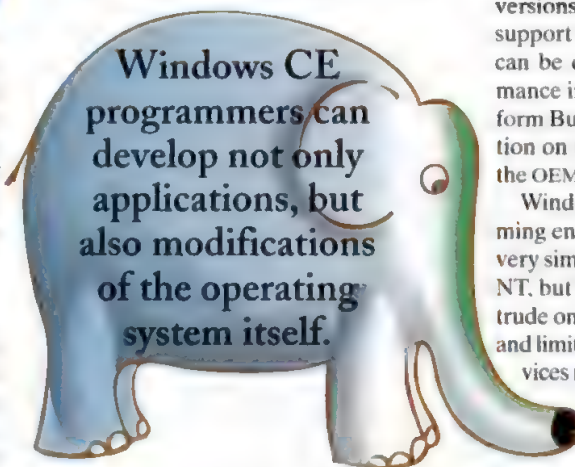
PC TECH

processes running on the device. The status information includes the current threads running in each process as well as the DLLs that process has loaded. A final tool is a memory viewer application that lets you browse the contents of the application's heaps. All of these tools run on the attached desktop PC and communicate with remote client software on the Windows CE device.

THE PLATFORM BUILDER

Developing applications for Windows CE is only one opportunity for developing with the operating system. While the desktop versions of Windows can be ported to different PC compatibles, the kits for doing this are closely held by Microsoft and its approved OEMs. Windows CE is different in that the Platform Builder kit, while expensive, is available through retail channels. Thus, Windows CE programmers can not only develop applications, they can develop modifications of the operating system itself.

The Platform Builder kit provides example source code for the OEM abstraction layer (OAL), which is the layer of code written by the OEM to adapt Windows CE to specific hardware. The OAL includes the Hardware Ab-



straction Layer (HAL) code to support the needs of the Windows CE kernel as well as drivers for built-in hardware such as the keyboard, touch screen and display. Sample source code is also provided for the audio and serial drivers and the PCMCIA controller driver.

The Platform Builder also includes low-

level debugging tools. While these tools are primarily designed to assist in porting Windows CE to new hardware platforms, they can also be used when diagnosing intractable problems with application software. Newer versions of Windows CE provide hooks to support a built-in Monte Carlo profiler that can be quite handy for optimizing performance in your application. Finally, the Platform Builder includes extensive documentation on the operation of Windows CE from the OEM perspective.

Windows CE is an interesting programming environment. The Win32 API makes it very similar to programming Windows 98 or NT, but the limitations of the hardware intrude on application design. The slower CPUs and limited memory of most Windows CE devices make you think about your programming in a different way, from an efficiency perspective. In fact, it's kind of refreshing to see programmers actually having to worry about CPU speed and code size in these days of multimegabyte PC applications. **PC**

Douglas Boling is a contributing editor of PC Magazine and the author of Programming Windows CE (Microsoft Press).

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#33230	2210	300 PII MMX	32	4.0GB	24X	12" TFT	56K	\$2,149
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Order#	Model	Processor	RAM	HD	CD	Display	Modem	Price
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Order#	Model	Processor	RAM	HD	CD	Display	Modem	Price
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- 12.1" HPA Display
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- 24X CD-ROM
- Windows 95

Order#	Model	Processor	RAM	HD	CD	Display	Modem	Price
#40901	1255	333 AMD-K6-2	32	4.0GB	24X	12.1" TFT	56K	Win 95 \$1,499
#40904	250	333 AMD-K6-2	64	4.0GB	24X	12.1" TFT	56K	Win 95 \$1,799
#42171	1920	300 PII	64	4.0GB	DVD	13.3" TFT	56K	Win 98 \$2,999

Order#	Model	Processor	RAM	HD	CD	Display	Modem	Price
#40901	1255	333 AMD-K6-2	32	4.0GB	24X	12.1" TFT	56K	Win 95 \$1,499
#40904	250	333 AMD-K6-2	64	4.0GB	24X	12.1" TFT	56K	Win 95 \$1,799
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#14034 HP DeskJet 722C Printer, up to 8ppm black, 4ppm color **\$279⁹⁹**
#37240 HP DeskJet 895Cse HP PhotoREt II, 10ppm black, 6ppm color **NEW! \$399⁹⁹**
#14717 HP OfficeJet 600 print, copy and scan in color, plain-paper fax **\$399⁹⁹**
#39355 HP PhotoJet 710 color printer, color scanner, color fax and copier **\$499⁹⁹**

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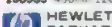
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102291	350MHz/64MB/10GB/10-100/NT	1529
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104283	266MHz/64MB/4GB/56K/14.1"TF	2439

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101594	300MHz/64MB/6GB/56K/12.1"TF	2729
101595	300MHz/64MB/6GB/56K/12.1"TF	2829

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109332	300MHz/64MB/4GB/24X/56K/13.3"TF	1899

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102877	300MHz/32MB/4GB/56K/12.1"TF	2799

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101323	266MHz/64MB/6GB/24X/56K/13.3"TF	\$2649
102883	300MHz/64MB/6GB/24X/56K/13.3"TF	3049
102882	300MHz/64MB/8GB/24X/56K/14.1"TF	3499
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Cross

52245	CrossPad XP 6" x 9"	\$349.95*
102534	After 5.00 mfr rebate	399

Franklin Electronics

101561	REX Pro 5 for Laptops	\$189.95
101562	REX Pro 5-DS for Desktops	209.95

Hewlett-Packard

49958	620LX Color Palmtop PC	\$699
105246	Jornada 820 190MHz/16GB/8.2"CTN/CE	899
59973	660LX Color Palmtop PC	899

Philips

55577	Nino 301 4MB w/Dock and Battery	\$299.95*
55578	Nino 312 8MB w/Dock, Battery and Modem	399.95
51843	Vero 500 16MB w/Dock	499.95
51844	Vero 500 24MB w/Dock	599.95

Psion

42282	Series 5 Palmtop 8MB	\$449.95
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Sharp

48466	Mobilin HC 4500	\$649.95
58197	Mobilin HC 4600 16MB	689.95
104295	Mobilin Pro PV 5000	979
104289	In-Pad P2-4000	999

MONITORS

Hitachi	43320 19" Elite 751	\$599
105741	21" SuperScan 811	999

IBM

107721	18.1" Flat Panel LCD TFT (White)	\$2949
107722	18.1" Flat Panel LCD TFT (Black)	2949

Iiyama

102655	17" VisionMaster 400	\$419
49695	19" VisionMaster 450	599
55681	21" VisionMaster 501	899

KDS USA

101805	14" VS-40	\$129
105750	15" VS-55	139
108713	17" VS-7E	229

MAG Technology

38304	15" D1530	\$149
38260	17" D1700	299
32695	17" DX700T Technitron	329

Mitsubishi

100825	NEW! 19" Diamond Scan 90E	\$659
183084	17" Diamond Plus 72	499
53318	17" Diamond Plus 100E	599
101099	21" Diamond Pro 1000E	1299


Tektronix

182731 Phaser 740L Color Capable Laser	\$1400
182734 Phaser 740 Color Laser Printer	1999
183872 Phaser 780 Color Laser Printer	4999

Xerox

190071 DocuPrint P8 Personal Laser	\$299.99
00446 DocuPrint P12 Personal Laser	640
00445 DocuPrint N24 Laser	2399
48289 DocuPrint N32 Laser	2799
00441 DocuPrint N40 Laser	3249

SCANNERS
Fujitsu

52943 ScanPartner 600C SCSI Flatbed w/ADF	\$1399
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Hewlett-Packard

180595 ScanJet 5200 Cite	\$299
181063 ScanJet 6200 Cite	399

IBM

104085 IdeaScan	\$134.95
104086 Flatbed Color	189.95

Microtek

104106 SlimScan C3 USB	\$49.95*
57799 ScanMaker 1861	229.95*
101546 ScanMaker 4	999

Minolta

40612 Dimage Scan Dual Film Scanner	\$699
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Nikon

50877 Super CoolScan 2000	\$1799
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Polaroid

51234 SprintScan 35 Plus	\$1399
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UMAX

181863 Astra 1220U	\$129*
54475 Astra 1220S Cross-Platform	149*
40085 Astra 1200S	149
51157 PowerLook II Duo/Photoshop LE	795*

Viewsonic

192580 PaperPort One-Touch 5300	399
182229 PaperPort One-Touch 7600 USB	149
40455 PaperPort Strobe Parallel	189*
46295 PaperPort Strobe Serial	189*

DIGITAL CAMERAS
Canon

57777 PowerShot A5 Digital Camera	\$499
57435 ZR MiniDV Camcorder	995
181874 Vixia MiniDV Camcorder	1295
57434 Optura MiniDV Digital Camcorder	1595
508882 XL1 MiniDV Camcorder	4495

Kodak

56887 DC220	\$699
56886 DC260	899

Olympus

55672 D-340L	\$499
184248 D-400 Zoom	799
47234 D-600L	899
184249 D-620L	1199

SONY

183386 Mavica FD61	\$799
185337 Mavica FD91	999

Toshiba

100997 PDR M1	\$495
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PROJECTORS
Epson

53677 PowerLite 5000iB LCD Projector	\$4999
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Infocus

181433 LP425 LCD Projector	\$3499
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181445 LP735 LCD Projector	6999
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Polaroid

48917 Polaview 215 LCD Projector	\$1299
52858 Polaview 211E LCD Projector	3499

INPUT DEVICES
Adesso

190779 Eagle Touch Keyboard PS/2, Win98	\$12.95
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54451 Powermouse Ergonomic PS/2	14.95
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30217 Nu-Form Split Key Keyboard PC	29.95
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30219 Nu-Form Split Key Keyboard w/TouchPad PC	44.95
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21245 Nu-Form Extended Keyboard PC	44.95
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Belkin

58895 USB 3 Button Mouse	\$19.95
58894 USB 104 Key Keyboard	39.95
48333 USB Express Hub	59.95

Cross Pen

52244 iPen Pro	\$99.95
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Good Systems Inc.

181826 Televisor T3 Pro PC TV Converter	\$299.95
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Kensington Technology Group

57085 Mouse in a Box Scroll PC	\$24.95
184477 WebCraze Internet Controller	59.95
39535 Orbit Trackball PC	49.95
25085 Expert Mouse	99.95

Keytronic Corporation

39689 104 Keyboard PS/2	\$24.95
40067 Keytronic Classic Keyboard	29.95
57890 Lifetime Mouse PS/2	39.95

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43843 First Mouse PS/2	\$18.95
182961 MouseMan Wheel Mouse	49.95
49728 Trackman Marble FX	79.95
182951 Cordless Desktop Keyboard and Mouse	99.95

Wacom

181572 Intuos 6" x 8"	\$299.95
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MULTIMEDIA
Creative Labs

100063 Blaster 486 CD-ROM Drive	\$79.95
53288 3D Blaster Voodoo2 128MB PCI	149.95
100142 Sound Blaster 128 plus 4-Pc. Speakers	149.95
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183447 PC DVD Encoder SX DVD-ROM Kit	249.95

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189515 CD-R Media 50-Pack	\$89.95
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189553 SureStore 8110i CD-Writer Plus External	399
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104268 NEW! Zip Drive USB	\$149.95
187817 NEW! Zip 250MB Parallel	139.95
183688 NEW! Disk Drive Plus 40MB	299.95
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186363 Jaz Drive 1GB SCSI External (Reformatted)	199.95
182641 Zip Drive Parallel External	119.95
182640 Zip Drive SCSI External	119.95
40990 Zip Drive API Interface	99.95
183933 Zip Disk 10-Pack (Gray)	99.95
32586 Jaz 1GB Disk 3-Pack	269.95
47879 Jaz 2GB Disk 3-Pack	299.95

Kodak

181649 CDR Media-30	\$89.95
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Memorex

53408 CDR 74mm 10-Pack	\$19.95
48589 CD-RW Disc 5-Pack w/5 FREE CD-R Discs	49.95
30629 CDR 74mm 100-Pack	149.95

Meridian Data

182484 8GB Snap! Server	\$649.95
182485 16GB Snap! Server	1099.95

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48843 DLT II 35/70GB Tape Cartridge	\$79.95
183062 3.2GB Fireball EX	129
55361 4.3GB 18.2GB AtlasII Ultra2 LVD SCSI HD	829
185238 19.2GB Bigfoot TS Ultra ATA HD	379
48842 70GB DLT 7000 Tape Drive	4899

Seagate

180972 3.2GB Medalist Ultra ATA HD	\$125
51476 4.3GB Medalist Ultra ATA HD	139
51474 6.6GB Medalist Ultra ATA HD	199
58294 8GB TapeStar Int. SCSI Travan Tape Drive	219
182889 10.2GB Medalist Ultra ATA HD	219
54282 9.1GB Barracuda 9LP Ultra Wide SCSI	439
59863 9.1GB Cheetah Ultra2 LVD HD	689
58324 18.2GB Cheetah Ultra2/LVD HD	1299

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583186 2x2x24 CD Racer	\$319.95
53467 4x12 CD Speedwriter SCSI Internal	349.95
53468 4x12 CD Speedwriter SCSI External	429.95

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58897 8.4GB Caviar Retail Packaged HD	169.95*
181327 10.1GB Caviar Retail Packaged HD	199.95*
185455 13.0GB Caviar Retail Packaged HD	249.95*

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182843 4x24i6 CRW4416S Internal SCSI	\$419.95
182844 4x24i6 CRW4416SX External SCSI	5499

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18559 Back-UPS 280 (180 Watts) online surge protector	\$39.95
56165 Back-UPS Office 280	84.95

56164 Back-UPS 300 (180W)	99.95
56167 Back-UPS 500 (330W)	149.95
56169 Back-UPS Pro 420 (260W)	229.95
56170 Back-UPS Pro 650 (410W)	279.95
31466 Smart-UPS 700 Net (450W)	369.95
21929 Back-UPS Pro 1000 (670W)	379.95
31469 Smart-UPS 1400 NET (950W)	529.95
31470 Smart-UPS 2200 NET (1600W) PowerChute	899.95

Belkin

53628 ReSource UPS	\$84.95
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Opti-ups

181381 280ES (280W)	\$89
181383 420ES (420W)	149

Tripp Lite

181189 Super 6 - Tel	\$15.95
6786 Isobar 4 Ultra	44.95
29274 BC Internet 325 VA (ultra min) 125 minutes	49.95
13147 Isobar 6 Ultra	64.95
21844 BC Pro 1400 UPS (940 Watts)	419.95
46891 SmartPro 1400 NET UPS	499.95

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3Com

53894 3Com/USR External Modem	\$129.95*
55284 Fast EtherLink XL with Wake Up 5-pack	399.95
51609 SuperStack II Dual Speed Hub 500 24-Port	949
53781 SuperStack II Switch 3300 24-Port	2149

Asantec Technology

38297 10BaseT FriendlyNet 8-Port Hub	\$49.95
187852 FriendlyNet 10/100 8-Port Hub	179.95
180863 FriendlyNet 10/100 8-Port Switch	309.95

Nortel Networks

103180 Baystack 350-24T 24-Port Switch	\$1799
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Belkin

104812 OmniCube 3-Port KVM Switch	\$69.95
104813 OmniCube 4-Port KVM Switch	119.95

Cisco

62627 Catalyst 2924XL 24-Port Switch	\$899
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DLink

187126 10/100BaseT 5-Port Switched Hub	\$84.95
104857 10/100BaseT 8-Port Switched Hub	159.95

HP Networking

182648 Jet Direct 170X Print Server	\$139
53458 JetDirect 300X 10/100 Print Server	229
100638 ProCurve 24-Port 10BT Hub	179*

Linksys

48834 PRO/100+ PCI Adapter 5-pack	\$399.95
183647 Create & Share Camera w/Software & Battery Kit	99.95*
184538 Netport Express 3-Port Print Server	329.95

Linksys

59629 10/100BaseTX PCI EtherFast LAN Card	\$19.95*
44783 10BaseT 5-Port Workgroup Hub	42.95
58286 10/100BaseTX 6-Port Auto-Sensing Hub	149.95
58288 StackPro II 16-Port 10/100 Hub	459.95
182706 EtherFast 10/100 24-Port Switch	979.95

Netgear

35404 FK310TX 10/100BaseT Fast Ethernet PCI Adapt.	\$24.95
187089 SW108 8-Port Switch w/2 FREE NIC Cards	189.95
187087 RT328 ISDN Router w/FREE 6-Port Hub	269.95
108116 Fast Ethernet 8-Port Switch	\$29.95

Netgear

108216 DS824 10/100 24-Port Hub	\$64.95
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Xircom

182700 Realport Ethernet 10/100	\$139.99
55424 Realport 56K Modem & 10/100BaseT Ext. Adapt.	309.99

SOFTWARE
Adobe Systems

54674 Adobe Photoshop 5.0 Version Upgrade	\$189.95
54675 Adobe Photoshop 5.0	599.95
18878 Adobe Illustrator 8 Upgrade	119.95
18880 Adobe Illustrator 8	359.95
43823 Adobe Acrobat 3.0.1	189.95
32847 Adobe PageMaker 6.5 Version Upgrade	119.95
32845 Adobe PageMaker 6.5	549.95
55125 Adobe Premiere 5 Version Upgrade	189.95
55127 Adobe Premiere 5	599.95
182823 Adobe Graphic Studio - Photoshop/Illustrator/PageMaker	929.95

AutoDesk

185180 Achte Technical	\$289.95
186328 AutoCAD LT 98	399.95

Computer Associates

183382 ARCserve 6.6 for WinNT & FREE DoubleIT	\$399.95
183334 IncoServer 4.5 Workgroup Ed. for WinNT	399.95

183263 ARCserve 6.6 w/ProPack & FREE DoubleIT	849.95
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Corel

57528 Corel PrintOffice	\$99.95
40873 Corel Photo-Paint 8 Upgrade	94.95
55722 WordPerfect Suite 8 w/Dragon Nat. Spoken Ling.	94.95
53662 Corel Ventura 8 Upgrade	189.95
55721 WordPerfect Suite 8 w/Dragon Nat. Spoken	289.95
48615 CorelDRAW 8 Upgrade	219.95
48619 CorelDRAW 8	429.95

Dragon

180242 Dragon Naturally Speaking Preferred	\$189.95
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COMPAQ		
OPTI P400 Celeron 300MHz (P400-001)		\$687.77
OPTI P400 Celeron 300MHz (P400-002)		\$1,236.91
HP		
HP C330 Celeron 300MHz (C330-001)		\$761.21
HP C330 Celeron 300MHz (C330-002)		\$1,137.81
IBM		
IBM Celeron 300MHz (Celeron-001)		\$867.10
IBM Celeron 300MHz (Celeron-002)		\$1,007.46
TOSHIBA		
TOSHIBA Celeron 300MHz (Celeron-001)		\$1,007.46

DESKTOPS (PENTIUM II)

COMPAQ		
OPTI P400 Pentium II 333MHz (P400-001)		\$1,000.51
OPTI P400 Pentium II 333MHz (P400-002)		\$1,171.71
HP		
HP C330 Pentium II 333MHz (C330-001)		\$1,161.71
HP C330 Pentium II 333MHz (C330-002)		\$1,161.71
IBM		
IBM Pentium II 333MHz (Pentium-001)		\$1,161.71
IBM Pentium II 333MHz (Pentium-002)		\$1,161.71
TOSHIBA		
TOSHIBA Pentium II 333MHz (Pentium-001)		\$1,161.71
TOSHIBA Pentium II 333MHz (Pentium-002)		\$1,161.71

NOTEBOOKS

COMPAQ		
OPTI P400 Notebook (P400-001)		\$1,000.51
OPTI P400 Notebook (P400-002)		\$1,171.71
HP		
HP C330 Notebook (C330-001)		\$1,161.71
HP C330 Notebook (C330-002)		\$1,161.71
IBM		
IBM Celeron Notebook (Celeron-001)		\$1,161.71
IBM Celeron Notebook (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Notebook (Celeron-001)		\$1,161.71
TOSHIBA Celeron Notebook (Celeron-002)		\$1,161.71

MEMORY UPGRADES

COMPAQ		
OPTI P400 Memory Upgrade (P400-001)		\$1,000.51
OPTI P400 Memory Upgrade (P400-002)		\$1,171.71
HP		
HP C330 Memory Upgrade (C330-001)		\$1,161.71
HP C330 Memory Upgrade (C330-002)		\$1,161.71
IBM		
IBM Celeron Memory Upgrade (Celeron-001)		\$1,161.71
IBM Celeron Memory Upgrade (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Memory Upgrade (Celeron-001)		\$1,161.71
TOSHIBA Celeron Memory Upgrade (Celeron-002)		\$1,161.71

NETWORKING

COMPAQ		
OPTI P400 Networking (P400-001)		\$1,000.51
OPTI P400 Networking (P400-002)		\$1,171.71
HP		
HP C330 Networking (C330-001)		\$1,161.71
HP C330 Networking (C330-002)		\$1,161.71
IBM		
IBM Celeron Networking (Celeron-001)		\$1,161.71
IBM Celeron Networking (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Networking (Celeron-001)		\$1,161.71
TOSHIBA Celeron Networking (Celeron-002)		\$1,161.71

PRINTERS

COMPAQ		
OPTI P400 Printer (P400-001)		\$1,000.51
OPTI P400 Printer (P400-002)		\$1,171.71
HP		
HP C330 Printer (C330-001)		\$1,161.71
HP C330 Printer (C330-002)		\$1,161.71
IBM		
IBM Celeron Printer (Celeron-001)		\$1,161.71
IBM Celeron Printer (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Printer (Celeron-001)		\$1,161.71
TOSHIBA Celeron Printer (Celeron-002)		\$1,161.71

DIGITAL CAMERAS

COMPAQ		
OPTI P400 Digital Camera (P400-001)		\$1,000.51
OPTI P400 Digital Camera (P400-002)		\$1,171.71
HP		
HP C330 Digital Camera (C330-001)		\$1,161.71
HP C330 Digital Camera (C330-002)		\$1,161.71
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IBM Celeron Digital Camera (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Digital Camera (Celeron-001)		\$1,161.71
TOSHIBA Celeron Digital Camera (Celeron-002)		\$1,161.71

PDAS

COMPAQ		
OPTI P400 PDA (P400-001)		\$1,000.51
OPTI P400 PDA (P400-002)		\$1,171.71
HP		
HP C330 PDA (C330-001)		\$1,161.71
HP C330 PDA (C330-002)		\$1,161.71
IBM		
IBM Celeron PDA (Celeron-001)		\$1,161.71
IBM Celeron PDA (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron PDA (Celeron-001)		\$1,161.71
TOSHIBA Celeron PDA (Celeron-002)		\$1,161.71

SCANNERS

COMPAQ		
OPTI P400 Scanner (P400-001)		\$1,000.51
OPTI P400 Scanner (P400-002)		\$1,171.71
HP		
HP C330 Scanner (C330-001)		\$1,161.71
HP C330 Scanner (C330-002)		\$1,161.71
IBM		
IBM Celeron Scanner (Celeron-001)		\$1,161.71
IBM Celeron Scanner (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Scanner (Celeron-001)		\$1,161.71
TOSHIBA Celeron Scanner (Celeron-002)		\$1,161.71

VIDEO CARDS

COMPAQ		
OPTI P400 Video Card (P400-001)		\$1,000.51
OPTI P400 Video Card (P400-002)		\$1,171.71
HP		
HP C330 Video Card (C330-001)		\$1,161.71
HP C330 Video Card (C330-002)		\$1,161.71
IBM		
IBM Celeron Video Card (Celeron-001)		\$1,161.71
IBM Celeron Video Card (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Video Card (Celeron-001)		\$1,161.71
TOSHIBA Celeron Video Card (Celeron-002)		\$1,161.71

MONITORS

COMPAQ		
OPTI P400 Monitor (P400-001)		\$1,000.51
OPTI P400 Monitor (P400-002)		\$1,171.71
HP		
HP C330 Monitor (C330-001)		\$1,161.71
HP C330 Monitor (C330-002)		\$1,161.71
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TOSHIBA		
TOSHIBA Celeron Monitor (Celeron-001)		\$1,161.71
TOSHIBA Celeron Monitor (Celeron-002)		\$1,161.71

SOFTWARE

COMPAQ		
OPTI P400 Software (P400-001)		\$1,000.51
OPTI P400 Software (P400-002)		\$1,171.71
HP		
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STORAGE

COMPAQ		
OPTI P400 Storage (P400-001)		\$1,000.51
OPTI P400 Storage (P400-002)		\$1,171.71
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MODEMS

COMPAQ		
OPTI P400 Modem (P400-001)		\$1,000.51
OPTI P400 Modem (P400-002)		\$1,171.71
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CD-WRITERS

COMPAQ		
OPTI P400 CD Writer (P400-001)		\$1,000.51
OPTI P400 CD Writer (P400-002)		\$1,171.71
HP		
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TOSHIBA Celeron CD Writer (Celeron-002)		\$1,161.71

POWER PROTECTION

COMPAQ		
OPTI P400 Power Protection (P400-001)		\$1,000.51
OPTI P400 Power Protection (P400-002)		\$1,171.71
HP		
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TOSHIBA Celeron Modem (Celeron-002)		\$1,161.71

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IBM Celeron Modem (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Modem (Celeron-001)		\$1,161.71
TOSHIBA Celeron Modem (Celeron-002)		\$1,161.71

MODEMS

COMPAQ		
OPTI P400 Modem (P400-001)		\$1,000.51
OPTI P400 Modem (P400-002)		\$1,171.71
HP		
HP C330 Modem (C330-001)		\$1,161.71
HP C330 Modem (C330-002)		\$1,161.71
IBM		
IBM Celeron Modem (Celeron-001)		\$1,161.71
IBM Celeron Modem (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Modem (Celeron-001)		\$1,161.71
TOSHIBA Celeron Modem (Celeron-002)		\$1,161.71

MODEMS

COMPAQ		
OPTI P400 Modem (P400-001)		\$1,000.51
OPTI P400 Modem (P400-002)		\$1,171.71
HP		
HP C330 Modem (C330-001)		\$1,161.71
HP C330 Modem (C330-002)		\$1,161.71
IBM		
IBM Celeron Modem (Celeron-001)		\$1,161.71
IBM Celeron Modem (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Modem (Celeron-001)		\$1,161.71
TOSHIBA Celeron Modem (Celeron-002)		\$1,161.71

MODEMS

COMPAQ		
OPTI P400 Modem (P400-001)		\$1,000.51
OPTI P400 Modem (P400-002)		\$1,171.71
HP		
HP C330 Modem (C330-001)		\$1,161.71
HP C330 Modem (C330-002)		\$1,161.71
IBM		
IBM Celeron Modem (Celeron-001)		\$1,161.71
IBM Celeron Modem (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Modem (Celeron-001)		\$1,161.71
TOSHIBA Celeron Modem (Celeron-002)		\$1,161.71

MODEMS

COMPAQ		
OPTI P400 Modem (P400-001)		\$1,000.51
OPTI P400 Modem (P400-002)		\$1,171.71
HP		
HP C330 Modem (C330-001)		\$1,161.71
HP C330 Modem (C330-002)		\$1,161.71
IBM		
IBM Celeron Modem (Celeron-001)		\$1,161.71
IBM Celeron Modem (Celeron-002)		\$1,161.71
TOSHIBA		
TOSHIBA Celeron Modem (Celeron-001)		\$1,161.71
TOSHIBA Celeron Modem (Celeron-002)		\$1,161.71

MODEMS

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MICROSOFT	FRONTPAGE	98	FRONTPAGE		\$12
MICROSOFT	OFFICE97PRO	PRO	353-00014		\$130
SYMANTEC	WINTERHUS	PRO	PRO		\$13
SYMANTEC	WINTERHUS	PRO	PRO		\$13
SYMANTEC	ACT 4.0	ACT 4.0	ACT 4.0		\$18
SYMANTEC	ACT 4.0	ACT 4.0	ACT 4.0		\$18
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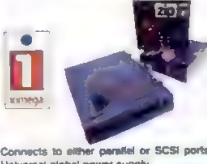
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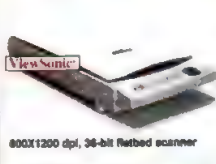
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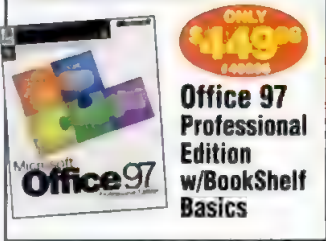
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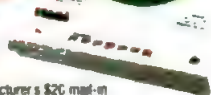
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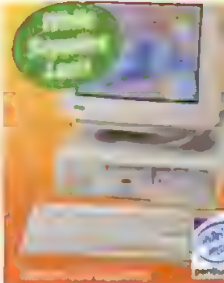


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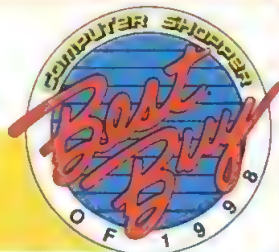
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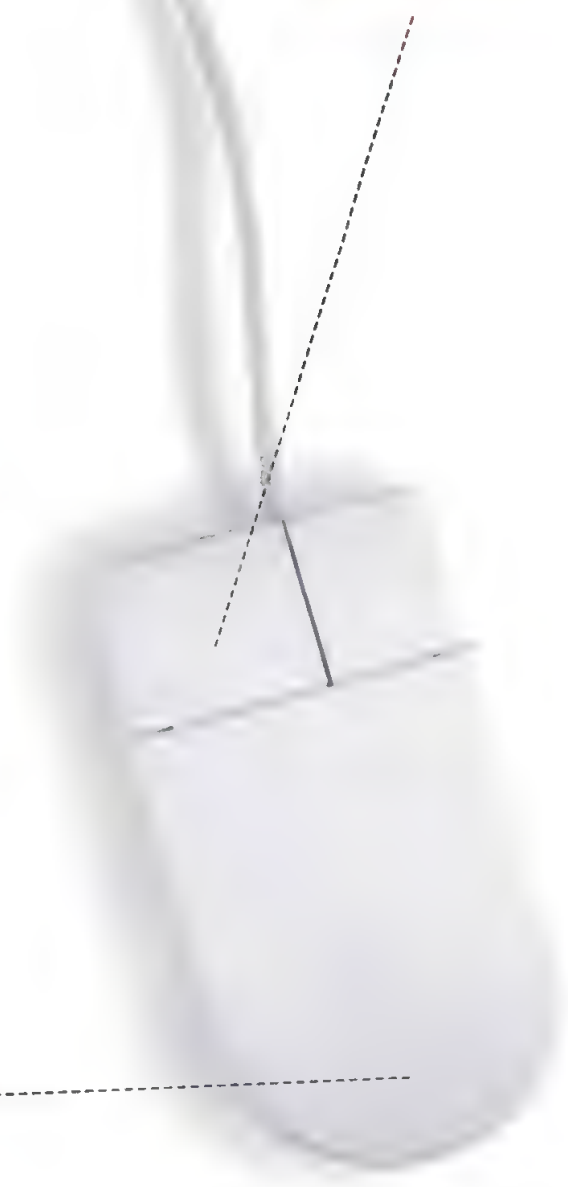
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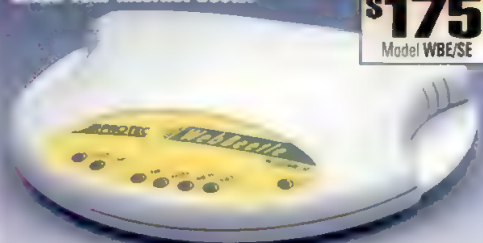
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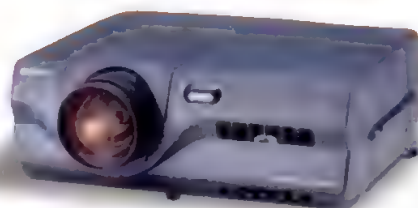
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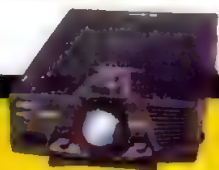
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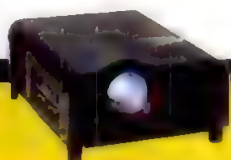
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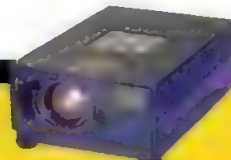
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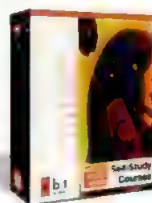
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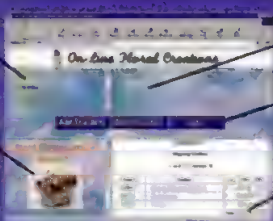
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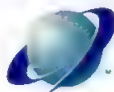
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Pentium III 700MHz	\$429	Pentium III 900MHz	\$529
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Pentium III 1300MHz	\$729	Pentium III 1500MHz	\$829
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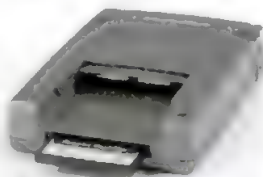
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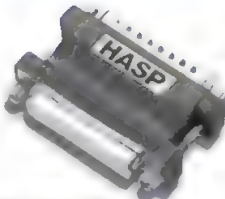
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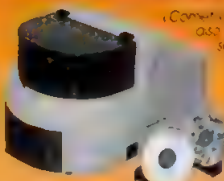
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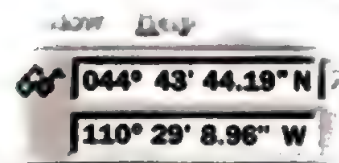
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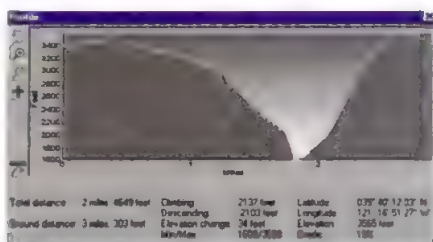
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AFTERHOURS

THE HOME SIDE OF COMPUTING



EDUTAINMENT

Creative Kids

By Jennifer Triverio

Although they may never be the next Pablo Picasso or Keith Haring, all children are born with a creative streak a mile wide. Nurturing such abilities can lead to a lifelong love of art—not to mention some priceless pictures for your refrigerator. The computer is the perfect medium for kids to explore art; it's not too messy, and there's some great software available for your budding artist.

In the following pages, we review five drawing and painting programs suitable for kids of various ages, from the preschooler to the teen in your family. The programs reviewed are *Art Dabbler*, *Disney's Magic Artist*, *Drawing Discoveries*, *Make A Masterpiece*, and *Paint 'n Play Pony*. Some are straight-ahead painting and drawing

programs; others incorporate games or learning activities. All encourage a child's creative expression.

On-screen play with these programs is fun and exciting, but we think one of the best things about art software is that it lets youngsters walk away from the computer with something tangible—their own pictures.

Art Dabbler

The most serious art tool reviewed here, *Art Dabbler* has long been a worthwhile investment for aspiring (and accomplished) artists. The current incarnation—*Art Dabbler 2.1*—is no exception, with its combination of robust painting and drawing tools and powerful digital imaging effects.

Using the metaphor of a sketch pad, the program's main

screen is highly intuitive. The on-screen "drawers" open at the click of a mouse to reveal both the available color palettes and the assortment of brushes, crayons, and pencils. Each drawing tool mimics its traditional counterpart: Markers bleed, and pencils are affected by different paper textures, for example. Kids will have a great time getting to know the program just by testing out the various tools and more than 120 paper textures at their disposal.

When it comes time to create a masterpiece, there's the choice to draw freehand or to use the Digital Tracing Paper, which lets kids trace any scanned photograph or digital image. They may opt to add some of the program's clip art, stencils, or stock photography to the mix. Drawing sessions can even be recorded, so that children can watch—stroke by stroke—how their masterpieces came to be.

You can save or print a completed project as is, of course, but

there's always the option of using some of the digital effects *Art Dabbler* borrows from its sister product, *Kai's Power Tools*. These include the ability to warp drawings or add textures to them.

In addition to the drawing and painting aspects of the program, *Art Dabbler* includes some much-appreciated extras. Multimedia art tutors present not only the basics of the program but also fun topics such as cartooning. There's even a lesson on how to create flip-book animations using *Art Dabbler*.

Rich in content and loaded with fun, *Art Dabbler* is a winner.

Disney's Magic Artist

What *Art Dabbler* offers to older kids *Disney's Magic Artist* provides to the younger set. The program is tons of fun without being all fluff. It offers a wide array of tools and options, all the while remaining intuitive and easy enough for the under-10 crowd to master.

Magic Artist sports the usual array of tools, including a pencil, paintbrush, and chalk—each of which comes in a variety of sizes and styles. The paint bucket lets kids pour solid colors, gradient fills, or patterns wherever they choose on the canvas. With the spritz bottle, they can spray the screen with a wacky assortment of patterns and colors. All the tools are conveniently stored in a drawer located on the left side of the "canvas."

Magic Artist includes plenty of stamps, props, back-

SID MEIER'S ALPHA CENTAURI

The long-awaited sci-fi strategy game. *Page 249.*



PUTT-PUTT ENTERS THE RACE

The spunky purple jalopy is back. *Page 250.*



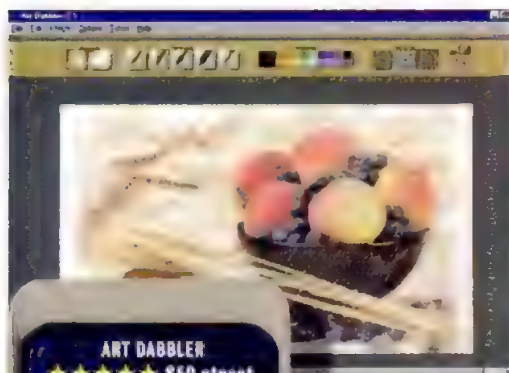
QUICK CLIPS

Our quick look at six new releases. *Page 252.*

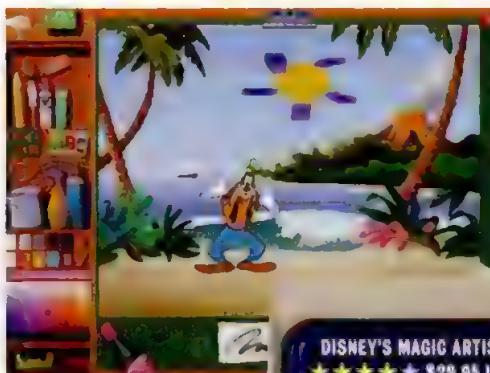


PHOTOGRAPH BY THOM O'CONNOR

AFTER HOURS



ART DABBLER
★★★★★ \$50 street.
MetaCreations Corp.,
800-846-0111,
www.metacreations.com



DISNEY'S MAGIC ARTIST
★★★★★ \$29.95 list.
Disney Interactive,
800-228-0989, www.disneyinteractive.com



DRAWING DISCOVERIES
★★★★★ \$9.95 list.
Brainstorm Software/
Interplay Productions,
888-427-2467,
www.brainstormfun.com

grounds, and foregrounds, plus—of course—Mickey and Minnie Mouse, Donald Duck, and the whole gang in a variety of playful poses. Kids can resize, rotate, and flip all the stamps, which can then be used as black-and-white line drawings or rendered in color.

The drawing lessons in Magic Artist alone are worth the disk's cost. In this section of the program, children can watch as Disney characters are drawn and animated stroke by stroke. The narrated lessons begin with the basics—Mickey's round ears, for example—and work their way

through all the rest, including Mickey's red shorts and white gloves. Kids can stop the animation at any time and trace it on-screen or with their pencils and paper.

The program has a few drawbacks, including a somewhat cramped canvas, the absence of a zoom tool, and the lack of layer

control (so if you bring a background in after placing characters, for example, it will paint over everything on the screen). But these are minor quibbles with an otherwise engaging program.

Drawing Discoveries

Unlike the other programs reviewed here, Drawing Discoveries shines when it comes to teaching your child how to draw—not in the number or array of drawing tools included. Though the program does contain painting and drawing options similar to those you'll find elsewhere, the strength of Drawing Discoveries lies in the program's step-by-step art lessons. And you can't beat the under-\$10 price tag.

Similar to the "How to Draw" books found in art classes across the world, this program not only takes the user through the creation of animals and landscapes but also includes lessons about art history and styles. Budding artists are given lots of instruction and the opportunity to practice.

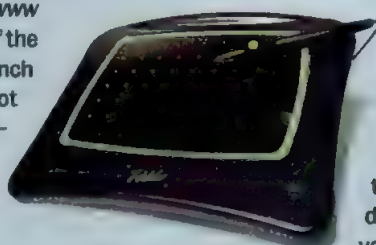
Drawing Discoveries embarks on a journey across Africa, where Akua (your child's gazelle guide) leads an art safari through the grasslands, the rain forest, and the desert. The young user selects which animal to draw—from lions and gorillas to giraffes

Drawing Tablets for Little Hands

Although all the programs we review here work well with a plain old mouse, if your child shows real interest in developing his or her artistic talents, you may want to consider purchasing a drawing tablet. Though drawing tablets have traditionally been geared toward professional artists and graphics folks, there are some products designed specifically with kids in mind.

One company, kidBoard (800-926-3066, www.kidboard.com), has made a business out of the kids' drawing market. It offers two 8- by 8-inch drawing tablets (that's the drawing area, not the total size), which plug into your computer's serial port. There's one for children as young as 4 or 5 and one for older kids. You can find them on retail shelves for about \$100 each.

The kidBoard SketchBoard targets younger kids and is bundled with Disney's Magic Artist art-studio software. The corded, pressure-sensitive pen is easy for little hands to grasp and maneuver, and the colorful contoured tablet fits snugly into little laps. The pen can be plugged into either side of the tablet, so it's



perfect for left- or right-handed drawers. And 1,280 lines per inch ensures that the SketchBoard will capture all the nuances of your kids' drawings. The tablet's tracing overlay and Magic Artist's template (a piece of paper that fits over the tablet and reproduces the program's on-screen toolbars and drawing tools, making them easier to select) make drawings simpler to create and keep frustration levels low.

For the more advanced artist in your family, the kidBoard Pablo is a must. The Pablo has approximately the same technical specifications as the SketchBoard and bundles Kai's Power GOO SE and Art Dabber. Both are robust programs that let kids explore their artistic talents. Though designed for children, don't be surprised if you find yourself reaching for Pablo; it's great fun and delivers high-quality output.

The kidBoard tablets are easy for children to master and enjoy with little supervision or assistance. They successfully bridge the gap between the professional arena, where drawing tablets are usually found, and children's bedrooms.—JT

and elephants—and then gets to watch a video about the animal. During the drawing lesson, detailed instructions are given both verbally and visually, and the artist draws along with the computer—either on-screen using the mouse or a drawing tablet or with the more traditional pen and paper. A lively narration and Africa-inspired sound track accompany the lessons.

Once the drawing is completed, the artist can color it using the painting section of the program, which includes a 24-color palette. Color mixing, shading, and texturing are not options, and the program does not confine coloring to within the lines of the drawing as easily as others do. As mentioned, this area is where Drawing Discoveries has some limitations (you can, however, import drawings into another painting program). The wonderful lessons do make up for this shortcoming.

Make A Masterpiece

The thought of using an art program created in part by Crayola was exciting when we received our copy of Make A Masterpiece. After all, who hasn't created a masterpiece or two using that trusty box of 64 crayons with the built-in sharpener?

Make A Masterpiece is designed for kids ages 5 to 12 and offers some interesting accompaniments to the traditional art program. These include a personal art guide named Scribble, who offers awards and idea starters (in the form of half-finished pictures, sketches, photos, and suggestions), and a journal filled with famous works from the National Gallery of Art in Washington, D.C., among other museums. Kids can also read about famous

artists, art styles, and techniques.

The heart of the program, though, is the art studio. Here kids will find the traditional and the unusual: crayons, stickers, and paintbrushes, plus wild tools

such as shaving cream, popping popcorn, or food you can throw at the canvas. There's also the Magic Effects tool, which remakes an entire painting in one of 12 styles, such as mosaic or pointilist.

Tools are located in buckets on the canvas. When the mouse is moved over a bucket it grows bigger, so that kids can easily see what tools are inside. Once a tool is chosen, a palette at the bottom of the canvas allows for customization of the color, size, and design of the tool. The buckets shrink and move out of the way while your children are working.

Your child can work from a blank background or choose one from Scribble's collection. His suitcase contains backgrounds from a huge variety of places, from the desert to the rain forest to the ocean.

Completed pictures can be framed and hung in the Art Gallery or displayed in a slide show.

Paint 'n Play Pony

An art program plus more traditional game play turns out to be a winning combi-



PAINT 'N PLAY PONY
★★★★★ \$19.95 list.
IBM Corp., 800-411-1932,
www.ibm.com/pc/us/software.

nation for any girl in the 5- to 10-year-old age range. Though certainly not a full-featured drawing or painting program, Paint 'n Play Pony does stimulate children's creativity, and the girls who tested it absolutely adored the pony theme and activities.

Hosted by Penelope the Pig,

the program invites kids to select their favorite pony to groom, name, and decorate. The game also provides a gallery for displaying your child's artistic creations and for writing original stories about the beloved equines.

Horses graze on a hillside on the main screen, from which a number of activities can be accessed. Double-clicking on one of the horses (which vary in breed, size, and color) brings up a full-screen picture of that

horse. Creative possibilities abound here, beginning with hair care options that let girls brush, color, cut, or grow the pony's hair or add braids, ribbons, or glitter. Moving on, children can add accessories, including hats, flower garlands, blankets, or leg warmers. Kids can use the 48 Crayola crayons to color and decorate their bedecked ponies.

Rounding out the creation is the selection of a name, a background, and, of course, pony friends to keep your child's horse company. Along the way kids learn about horse care, grooming, and famous horses throughout history. Completed projects can be displayed in a gallery or written about in the program's journal, which offers story starter ideas as well as Penelope's horse stories.

For all your little girl's hard work and dedication to her horse, she'll be rewarded with printable awards and certificates (as well as horse-themed stationery).

PC EDITORS' HOT LINKS

www.pcmag.com/hotlinks

Software is a wonderful way to explore art with your children, but there are other options. Here's a list of online sites to help further your children's forays into art.

► Art for Kids

artforkids.tqn.com

This is The Mining Company's top-notch resource for tracking down arts-and-crafts Web sites for kids of all ages and abilities. There's even an area where you can trade information with other parents.

► Crayola FamilyPlay

www.familyplay.com

Though this is a commercial site, it's not a hard sell and offers kids a variety of art-related interactive games, projects, and pictures to color.

► Kids' Space

www.kids-space.org

Designed to give kids a rewarding experience on the Internet, the colorful Kids' Space site lets kids color pictures and create storybooks. Your child's picture can even appear in the site's gallery.

► Wyland Kids

www.wylandkids.com

Part coloring book, part environmental-education resource, this site gives kids the chance to print and color animals and whales, in addition to reading up on our imperiled wildlife.

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STRATEGY

Rebirth of a Legend

By Michael E. Ryan

In the classic game Sid Meier's Civilization, your goal was to be the first nation to leave Earth and colonize the nearby star system Alpha Centauri. As you might guess from the title, Sid Meier's Alpha Centauri lets you play out events from that point forward. Though the game is not a sequel to Civilization, it is decidedly similar. And it offers the same addictive game play that kept Civilization's players glued to their monitors for "just one more turn."

Alpha Centauri begins when your human colony crashes on a world creatively named Planet. During the voyage from Earth, the colonists have split into seven rival factions, each with its

own belief system and behaviors. For example, the Morganites are all about business and economic growth, while the Hive is more

of an expansionist, communistic group. You take over the leadership of one of these factions, and in order to win—and survive—you must employ whatever means neces-

sary to defeat the others.

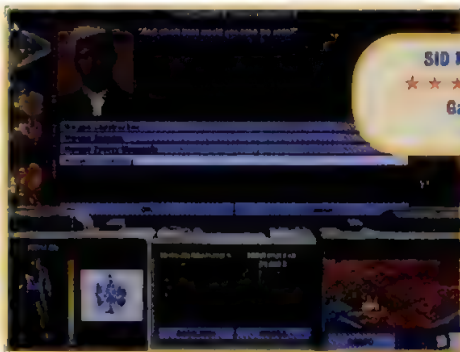
You begin with a single colony town on Planet and must expand your faction's influence by building additional towns, bulking up your military, and forging alliances with rival factions. The game play is similar to that in Civilization, with

turn-based movement and a heavy emphasis on managing the production needs and capabilities of your towns.

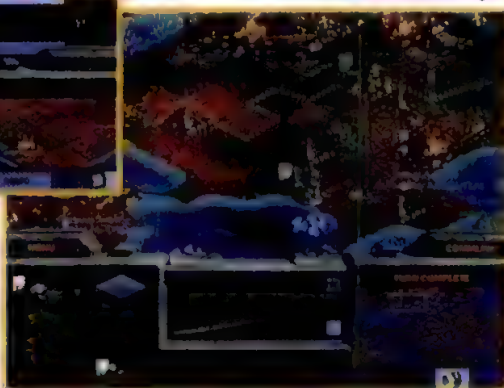
The game offers plenty of new and enhanced features as well. For example, the diplomacy system is extremely powerful and lets players forge all manner of interfaction relationships. There is also a Planetary Council feature, which lets you call all faction leaders together to vote on an important issue (such as the

election of a planetary governor). And all of the military units are new; you can even modify them.

Mixing new features with a time-tested gaming formula does not always pan out, but in the case of Sid Meier's Alpha Centauri the combination works beautifully.



SID MEIER'S ALPHA CENTAURI
★★★★★ \$49.95 list. Firaxis
Games, 800-245-4525,
www.firaxis.com.



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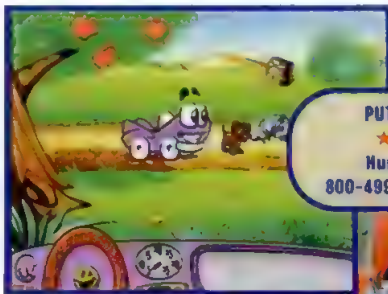
By Troy Dreier

He's been to the moon and he's gone back in time, but this time Putt-Putt is staying closer to home. He's entering the Cartown 500 in *Putt-Putt Enters the Race*—if he, with the aid of your children, can first overcome a few challenges.

Before the race, Putt-Putt needs to find a few speedway essentials, such as high-octane gasoline and a safety helmet for his little dog, Pep. Searching through Cartown, he talks to his neighbors and discovers other problems that need solving. Putt-Putt is, of course, always ready to pitch in. That gives him plenty of time to teach lessons on helping others and the value of recycling.

Young players learn to reason

and solve problems in sequence. For example, Putt-Putt can't get Mr. Fenderbender's cat down from a tree until he gets a ladder.



PUTT-PUTT ENTERS THE RACE
★★★★★ \$29.99 list.
Humongous Entertainment,
800-499-8386, www.humongous.com.

But he can't borrow a ladder from Smokey the Fire Engine until he earns his junior firefighter badge. Not that it's all work; there are plenty of laughs in Cartown. Story elements and puzzles change, so kids can play over and over without getting bored. And

as in other Humongous Entertainment games, there are clickable hot spots on each screen. Each produces a funny response, keeping kids entertained.

Kids can enjoy a few games that are just for fun. The Cartown 500, for example, is a challenging racing game, in which kids control Putt-Putt as he zooms around

for young ones to understand fully. A third game, which requires players to pound nails into a board, is so dull it makes us wonder what the developers were thinking.



We have only kudos, though, for the game's humor and fifties-style surf rock throughout. Read the end credits and you'll find that Putt-Putt is now voiced by Nancy Cartwright, better known as the voice of Bart Simpson.

If there's a 3- to 8-year-old on your shopping list, you can't go wrong with *Putt-Putt Enters the Race*.

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For the neophyte and the expert, Complete Chess's combination of three programs at three skill levels—Maurice Ashley Teaches Chess, Power Chess, and Extreme Chess—makes it a program you can grow with. \$39.99 list, Sierra Attractions, 800-757-7707, www.sierra.com.



Future Cop: LAPD

Set in 21st century Los Angeles, Future Cop offers two distinct game modes—the shooter-style Crime War and the strategy-based Precinct Assault—that guarantee varied gaming. Both modes feature great graphics and lighting effects, as well as multiplayer options. \$49.95 list, Electronic Arts, 800-245-4525, www.ea.com.

Luftwaffe Commander

You'll need a killer computer system and a real affinity for WWII to get the most out of this combat flight simulator. Unless your PC is equipped with the latest and greatest in 3-D acceleration, the graphics are subpar. Also, we wish the damage model was more realistic. For your money, Jane's WWII Fighters is the better bet. \$49.99 list, Strategic Simulations Inc./Mindscape Inc., 800-716-8503, www.ssionline.com.

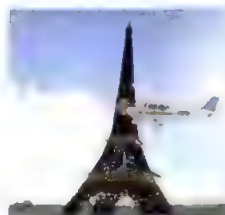


Myth II: Soulblighter

Myth II hits a home run with better game play, graphics, and multiplayer options than its predecessor. Set 60 years after the battles in The Fallen Lords, Myth II has you besieged by the undead and the cruel Soulblighter. \$49.95 list, Bungie Software, 800-295-0060, www.bungie.com.

Pro Pilot '99

Making dramatic improvements over the lame Pro Pilot '98, the latest version will please new users looking for an intensive flight sim training program. Although the flight model is certainly not as realistic as Microsoft Flight Simulator's, Pro Pilot offers beginners everything they could want in a flight program. \$49.99 list, Dynamix/Sierra, 800-757-7707, www.sierra.com.



Test Drive Off-Road 2

Any thoughts of raucous off-road fun go right out the window when you start to play this racing game. A clunky interface and forgettable graphics coupled with a dearth of tracks make this game a real lemon. \$40 street, Accolade, 800-245-7744, www.accolade.com.

Coming Up

What's in the Next Issue of *PC Magazine*

Y2K Countdown

Don't panic. Our countdown checklist will cover everything you should expect and explain what you can do now to minimize computer-related risks in the year 2000.

Digital Video Cameras

For Web sites, corporate training, and marketing videos, nothing beats the convenience of a digital video camera. PC Magazine Labs will test ten digital camcorders priced below \$2,000.

Free Web Home Pages

We'll look at the top sites offering free space, Web-based tools, and support for your personal or small-business home page.

Home Networks

PC Magazine Labs will test a dozen home networking kits—including the new wireless and phone-line entries—and rate them for speed, robustness, and ease of use.

After Hours

Need to book a flight? a hotel? a vacation package? We'll review six of the top online travel sites and let you know which ones soar and which ones leave you grounded.



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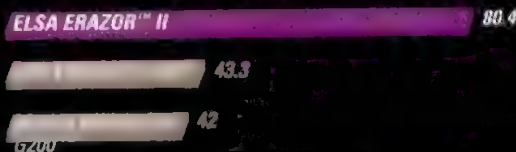
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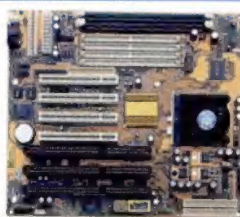
Tiger 571 AT Socket 7 Motherboard

Motherboard & Case: Motherboard mounted in dual-cooling fan case; 200 Watt power supply, cable & manual. Sound and video.

Pre-Assembled Kits: Motherboard in dual-cooling fan case; 200 Watt power supply, keyboard, speakers, mouse, 56KFlex fax/modem, 1.44MB floppy drive, 24X CD-ROM. Sound and video on board.

Tiger 571 Motherboard Features At-A-Glance

Form Factor: Baby AT On Board Video: 4MB ISA Slots: 3
Processor: Socket 7 On Board Audio: YES Memory: DIMM or SIMM
Bus Speed: Up to 83MHz PCI Slots: 4 Max Memory: 384 MB



Tiger 6KE LX, 6BE+ BX AGP Slot 1

FREE FLOPPY DRIVE!

Retail Motherboard: Motherboard cables & manual
Motherboard & Case: ready to assemble! Includes motherboard in dual-cooling fan case; 235 Watt power supply, cables & manual



Tiger 6KE LX Motherboard Features At-A-Glance

Form Factor: ATX • CPU: Slot 1 • Bus Speed: Up to 66 MHz • PCI Slots: 4
• ISA Slots: 3 • Memory: 3 DIMM Sockets • Max Memory: 384 MB

Tiger 6BE+ BX Motherboard Features At-A-Glance

Form Factor: ATX • CPU: Slot 1 • Bus Speed: Up to 100MHz • PCI Slots: 4
• ISA Slots: 3 • Memory: 3 DIMM Sockets • Max Memory: 768 MB

Tiger SY-SEMA ATX Super Socket 7

Retail Motherboard: Motherboard cables & manual—this motherboard features—2 DIMM and two SIMM sockets, 2ISA/5 PCI/1 AGP Slots, ATX formfactor, 100MHz bus support and more.

Motherboard & Case: Motherboard mounted in dual-cooling fan ATX case; 235-watt power supply, cables, manual



Tiger SY-SEMA Motherboard Features At-A-Glance

Form Factor: ATX • CPU: Socket 7 • Bus Speed: Up to 100 MHz • AGP Slots: 1
• PCI Slots: 5 • ISA Slots: 2 • Memory: 2DIMM/2 SIMM Sockets • Max Memory: 128MB

Tiger 767 AT, 760 ATX Slot 1

Motherboard & Case: Motherboard mounted in dual-cooling fan case; cables & manual

Pre-Assembled Kits: Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56KFlex faxmodem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.



AT Slot 1 with 4 PCI/1 ISA

Tiger 767 Form Factor: AT • CPU: Slot 1 • Bus Speed: Up to 100 MHz • On Board Video: 8MB AGP • On Board Audio: YES • PCI Slots: 4 • ISA Slots: 1 • Memory: DIMM • Max Memory: 768 MB

Tiger 760 Form Factor: Micro ATX • CPU: Slot 1 • Bus Speed: Up to 100MHz • On Board Video: 8MB AGP • On Board Audio: YES • PCI Slots: 3 • ISA Slots: 1 • Memory: DIMM • Max Memory: 768 MB

Motherboard Design	Processors Supported	MOTHERBOARD ONLY		MOTHERBOARD & CASE		PRE-ASSEMBLED KITS	
		Item No.	1-2 units	3+ units	Item No.	1-2 units	3+ units
Tiger 571 AT including Wave Table sound and PCI video	AMD Up to K6-300 & K62-266 Intel Pentium up to 233 MMX IBM/Cyrix Up to PR300	MB1-C-1B	\$75.99	\$68.99	BB1-C-1B	\$124.99	\$114.99
Tiger SY-SEMA Super Socket 7 1MB Cache	All AMD Up to K62-400; Intel Pentium up to 233 MMX IBM/Cyrix up to MII 350	MB1-T-7A	\$59.99	\$54.99	BB1-C-2C	\$129.99	\$119.99
Tiger 767 AT Slot 1 with Sound & AGP video	Celeron up to 333MHz Intel Pentium II up to 500MHz	MB1-E-5A	\$99.99	\$91.99	BB1-E-5A	\$154.99	\$142.99
Tiger 760 Micro-ATX Slot 1 w/Sound & AGP video	Celeron up to 333MHz Intel Pentium II up to 500MHz	MB1-E-6A	\$99.99	\$91.99	BB1-E-6A	\$139.99	\$128.99
Tiger 6KE LX ATX Slot 1	Celeron up to 333MHz Intel Pentium II up to 333MHz	MB1-T-10A	\$46.99	\$37.99	BB1-T-10A	\$114.99	\$99.99
Tiger 6BE+ BX ATX Slot 1	Celeron up to 500MHz Intel Pentium II up to 500MHz	MB1-T-9A	\$84.99	\$77.99	BB1-T-9A	\$149.99	\$139.99

Power Your Motherboard With A Premium Processor!

AMD-K6-2 With 3DNow!

Tiger recommends the Super Socket 7 motherboard with these CPUs

AMD K6-2 Processors	1-2 Units	3 units or more
#CP2-K62-300 300 3DNow!	\$74.99	\$72.99*
#CP2-K62-333 333 3DNow!	\$105.99	\$100.99**
#CP2-K62-350 350 3DNow!	\$109.99	\$104.99*
#CP2-K62-380 380 3DNow!	\$139.99	\$132.99**
#CP2-K62-400 400 3DNow!	\$164.99	\$156.99*

IBM/Cyrix MII

Tiger recommends the AT motherboard or the Tiger Super Socket 7 motherboard with these processors.

IBM/Cyrix MII	1-2 Units	3 units or more
#CP2-6X300 MII 300 CPU	\$52.99	\$49.99
#CP2-6X333 MII 333 CPU	\$59.99	\$56.99*
#CP2-6X350 MII 350 CPU	\$64.99	\$61.99*

Intel Celeron & Pentium II MMX

Intel Celeron & Pentium II Processors

	1-2 Units	3 units or more
#CP1-C1300A Intel Celeron 300A (128K cache) processor w/fan	\$74.99	\$69.99
#CP1-C1333 Intel Celeron 333 (128K cache) processor w/fan	\$99.99	\$94.99
#CP2-P2-350 Intel Pentium II 350 processor No fan*	\$239.99	\$232.99
#CP2-P2-400 Intel Pentium II 400 processor No fan*	\$359.99	\$341.99
#CP2-P2-450 Intel Pentium II 450 processor NO fan*	\$529.99	\$503.99

Sorry, but as prices are always changing on CPUs and memory, we do not offer price protection in the event prices rise or fall. *Requires 100MHz bus motherboard and bns PC100 SDRAM Memory. **Requires 95MHz bus motherboard and bns PC100 SDRAM. 11 Requires 83MHz bus motherboard. Call us for details and warranty information. No returns accepted on CPUs.

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TC1-2000	Intelli-Wheel Mouse	\$9.99	\$6.99

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FROM \$6.99

Item #	Description	1-2 Units	3 units or more
TC1-1000	Enhanced Keyboard	\$9.99	\$6.99

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Great sound! Great price!

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Item #	Description	1-2 Units	3 units or more
TC1-3000	Self-Amplified Speakers	\$9.99	\$6.99

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Rockwell-Based 56.6K Flex, Fully Compatible PCI Modem With 230K Hyper Modem Feature!

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16MB 72-Pin EDO	\$41.99
32MB 72-Pin EDO	\$49.99
32MB 168-Pin SDRAM	\$39.99*
64MB 168-Pin SDRAM	\$79.99*

Prices subject to change. * Price After Rebate

Quantum

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10.2GB THD-10C **\$199.99**

THD-1C Seagate 1.7GB UDMA	\$99.99
THD-4A Seagate 4.3GB UDMA	\$124.99

Build Your System With A Rugged Tiger Case!

Looking for the perfect case for your Tiger motherboard, well, here they are. The Tiger AT, ATX, and ATX Server Cases all include a mid-tower design, removable side panel.

CA1-C-1A AT Case 9-Bay 200-Watt Power supply	\$44.99
CA1-C-2A ATX Case 6-Bay 235-Watt Power supply	\$57.99
TCA-M-5A ATX Server 6-Bay 300-Watt Power supply	\$99.99

1.44MB 3.5" Drives

1.44MB 3.5" Drives

FROM \$14.99

Item #	Description	1-2 Units	3 Units
S190-1002	3.5" 1.44MB Floppy Drive	\$17.99	\$14.99

Cooling Fan SALE!

Cooling Fan SALE!

Protects your CPU against the damaging effects of heat!

FROM \$3.99

Item #	Description	1-2 Units	3 Units
C183-1000	Socket 7 Fan	\$4.99	\$3.99
C183-1000	Pentium II Fan	\$5.49	\$4.99

Supports Socket 7 AMD, Intel, Cyrix/IBM CPUs.

abort. retry. fail?

THE LIGHTER SIDE OF
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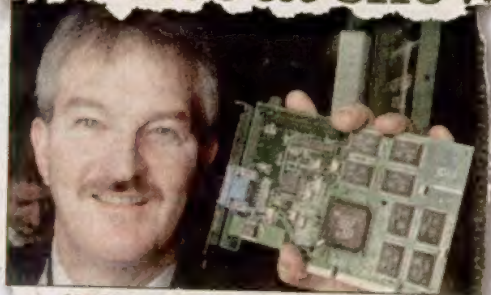
Edited by Don Willmott

Obviously the headline editor and the photo editor don't sit near each other.

(Austin American-Statesman.)

Austin American-Statesman

Handheld devices are hot at show



ARF on the
Road: New
Orleans,
Louisiana.



Oh, Canada!

Here's a review of a "reference work every Canadian should have" in a Toronto computing newspaper:
"Northern Neighbours: Disc four is the Land of the Inuit, a revealing look at our northern neighbours. Here we can learn about the culture and way of life of these hardy original Canadians. Topics include how they hunt seal, cross open ice, construct dogsleds, and handle the dogs."

If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802 or via e-mail to don_willmott@zd.com.
Winners this issue: Randall Brady, Rodger Falconer, Alan Gies, Mary Mitchell, and John Waymouth.



Our advice: don't bother worrying about it.

(Home & Office Computing.)



When PC Magazine technical director Nick Stam asked CompUTech about this ad, a sales rep told him, "Well, we put two 300-MHz CPUs in the system. Just add it up!"

Jan. 1 2000, The Ultimate Challenge for Small Business

How's That Again?

Faithful reader John Waymouth reports that at a recent computer show, a demonstration of Dragon NaturallySpeaking went a trifle awry when the demonstrator dictated, "A gentleman," and the software recognized it as "Salmonella."

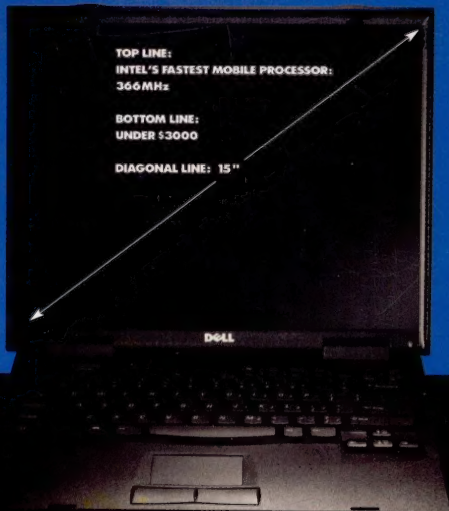
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When I said "backing up" was our best defense against the Y2K problem, I meant backing up the data...

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- 3Com® USR V.90™ PCI Telephony WinModem
- Trial Offer ConnectDirect™ Internet Access¹
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